DECEMBER 1969

Railway Signaling & Communications

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RACO®

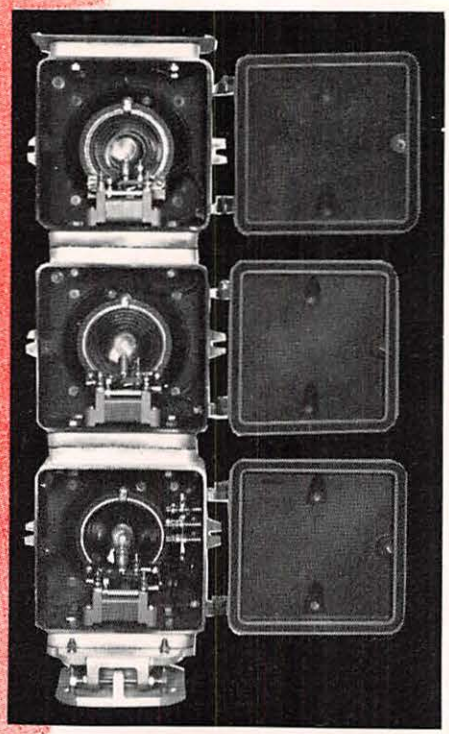
MODEL CLS-10

ALL ALUMINUM

COLOR LIGHT SIGNALS

DESIGNED FOR

MAXIMUM BEAM CANDLEPOWER



MODULAR DESIGN

The RACO CLS - 10 is available in 1, 2, 3 or more unit packing for vertical or horizontal mounting.

RACO CLS-10

signal head is easily ranged, aligned and fixed in both vertical and horizontal planes. The entire head assembly is weather tight featuring individual doors fitted with closed cell neoprene gaskets. Lenses and lamp receptacles are pre-focused and sealed at the factory to assure maximum optical efficiency.

ALL ALUMINUM

except ladder assembly which is galvanized steel, to assure long life with minimum maintenance.

LIGHT WEIGHT

offers easier handling and installation . . . cuts shipping costs too . . . the 3-unit assembly weighs less than 100 lbs.

RACO ENGINEERED to provide dependable signal indication under all operating and weather conditions.

MEETS AAR SPECIFICATIONS

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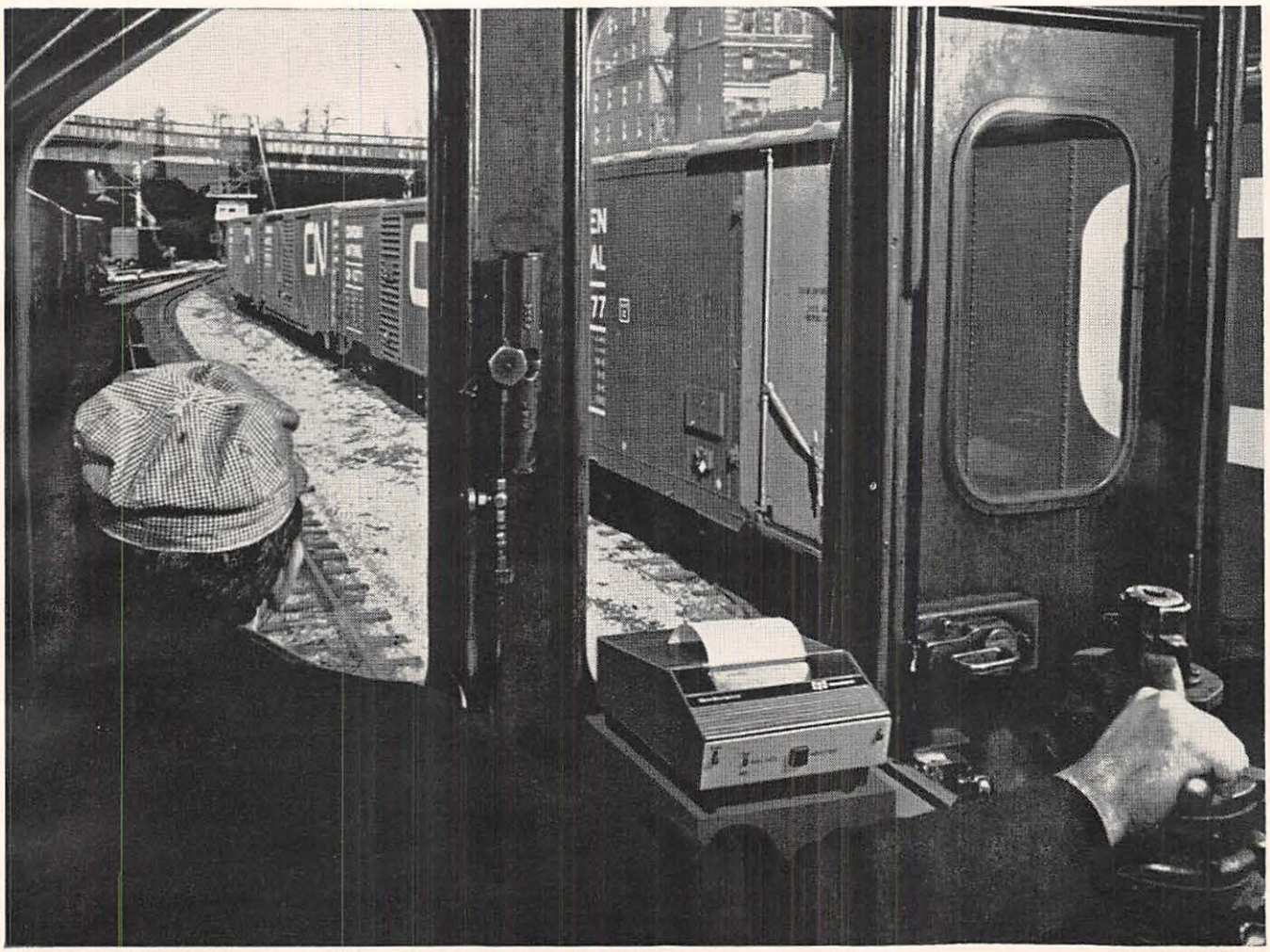
Circle 1 on reader service card



When Tom Toscano is busy moving freight, Kleinschmidt can take his messages.

Put Tom Toscano at the controls of a 45-ton locomotive and he's concentration itself. That's why a Kleinschmidt Telescripter® can be so valuable.

The Telescripter eliminates the distraction of voice messages. It prints them instead. At 100 words per minute. Time designations. Track numbers. Car numbers. Freight sequence.

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This marvelous little machine plugs into any two-way radio. And because the messages are printed instead of spoken, they're always free of static and interference.

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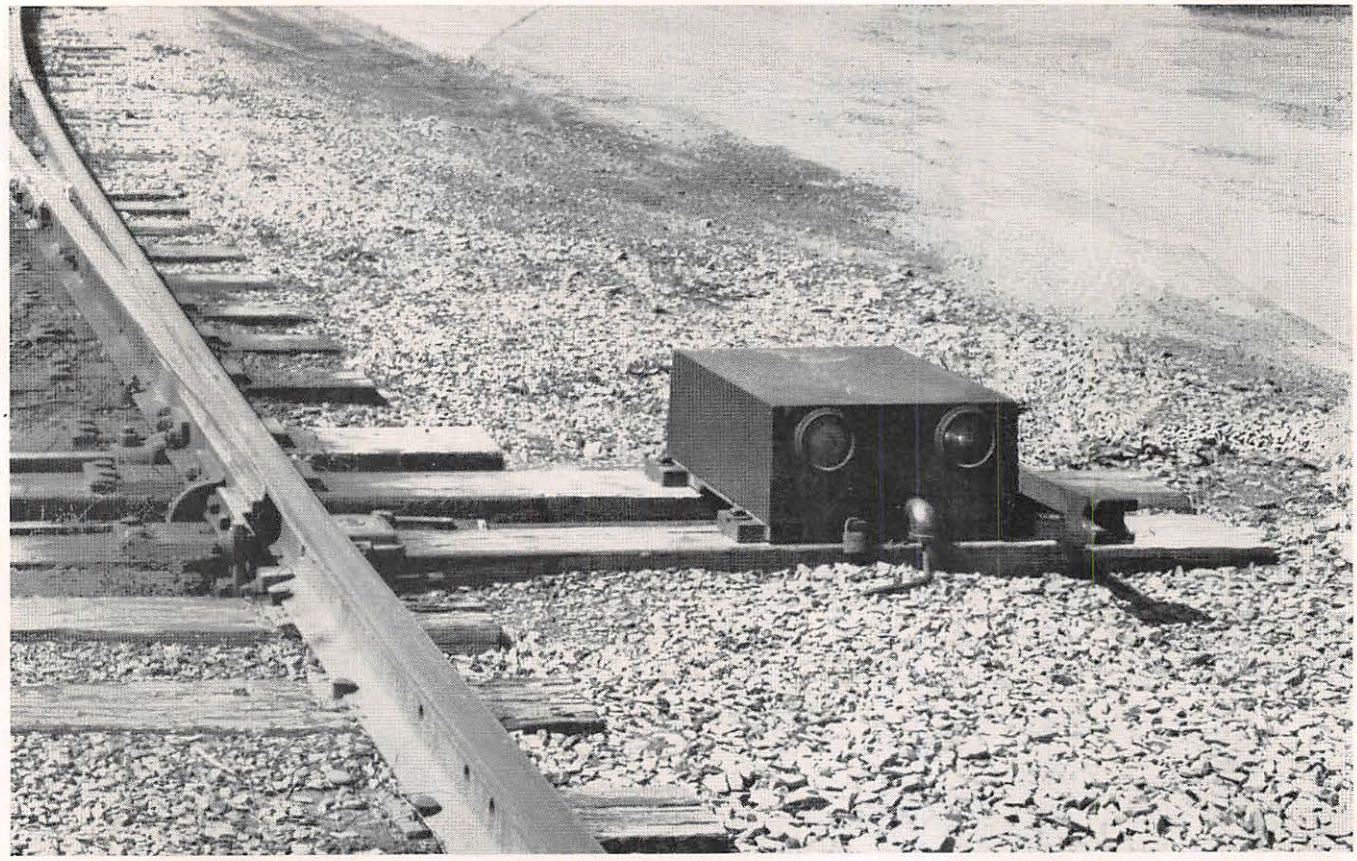
KLEINSCHMIDT

SCM®

FCC has adopted rules authorizing issuance of regular licenses for vehicular use of radioteleprinters in Police, Fire and Railroad Services, effective August 27, 1969.

Circle 4 on reader service card



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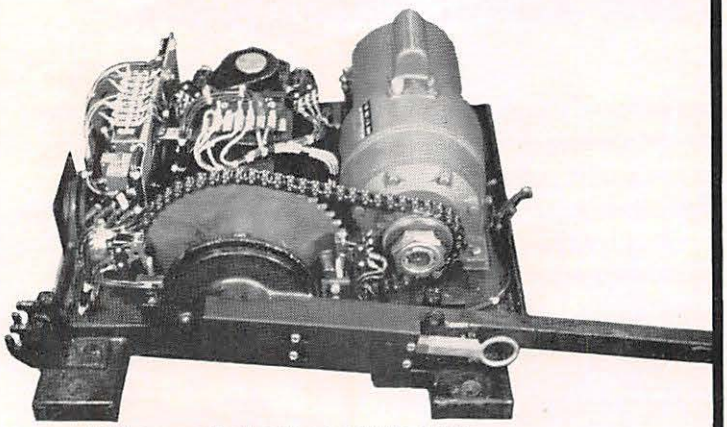
New GRS Electric Switch Machine has every feature you need for efficiency in noninterlocked service.



With cover off all parts are easy to get at.

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Trailable—in either direction, with full point pressure.

Reversible in Midstroke

Internal Contacts—to indicate position remotely.

Fast Operation—well under one second.

Automatic Restoration*—in case of obstructed point.

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The versatile Speed-Frater is designed specifically for receiving, departure and industrial yards. Ask for PD-25 for more information.

**Optional feature*

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Circle 5 on reader service card

December 1969
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Editor's Corner

There has always been a need for interdepartmental cooperation in railroading. And now the need is reinforced with the introduction of nationwide automatic car identification. Also, there are other areas where such cooperation can be helpful. This is not to say that there has not been cooperation in the past, but rather that at year end, it might be worthwhile to take stock. For example, there are still some problems of proper car handling in automatic classification yards. If the process control computer is involved, the data processing department is often added to the cooperative effort that involves signaling, operating and mechanical departments. S, O & M, as these three latter departments might be called, also are involved in the proper and effective use of hotbox detectors.

A recent mechanical-signal problem has been that of interference with audio frequency track circuits, apparently produced by alternators on diesel-electric locomotives. Experience with this problem indicates that it is an intermittent one—some locomotives interfere with the proper operation of some audio frequency track circuits. The alternator operates off the diesel engine to supply AC for traction motor blowers and ventilating fans. One type of alternator generates up to 195 volts AC at 120 Hz with engine speeds up to 900 rpm. Obviously, it does no good to bewail this condition and hope that the 27,000 diesel locomotives on the U.S. railroads will be modified to eliminate the problem. Rather, it will be up to the signal engineers to solve it at the track circuit level. Some roads that have not experienced interference, credit it to the use of modulation techniques in the overlay circuit transmissions.

Also, in the track circuit area, is the perennial problem of m/w forces raising track, replacing ties and rail or installing welded rail. This usually requires the on-the-job presence of signal maintenance men to keep track circuit connections, bootlegs, insulated joints and rail bonds in proper condition for effective and continued safe operation.

This cooperation among department heads is really the key to success. If the top men get along well, understand each other's problems and viewpoints, then it is relatively easy for staff and field forces who handle the day-to-day and working details to solve any problems. With this friendly, cooperative attitude, the buck is not passed, and small problems do not evolve into crises.

Bob McKnight

When you care

enough to send the very best.

We could tell you that our microwave systems are the world's greatest. But you'd expect us to be partial.

So we'll just give you some facts and let you judge for yourself.

For example, our new 78A for the telephone industry. It's pretty much like everybody else's 960-channel system. Except that the linearity and delay characteristics are so good that it handles 25% more voice channels. That's 1200 on short-haul routes. It's the only baseband system that does.

Or our 75C and new 78J for government applications. They're the only heterodyne and baseband systems of their kind that can handle 600 DCS circuits with 100% data loading.

Then there's our 76 and 78 baseband systems for railroads, electric utilities, pipe lines, and TV. Their noise performance is so good they're even used for transcontinental routes.

It's no coincidence that you'll find Lenkurt microwave systems in AUTOVON, AUTODIN, INTELSAT, and COMSAT networks.

Or that more than 200 commercial, industrial, and government customers are operating more than 600 separate Lenkurt microwave systems in 40 countries. Over a quarter of a million route miles.

There are plenty of "good" microwave systems around. But maybe you're in the market for something more. Call it experience. Call it reputation. Whatever it is, a lot of people think Lenkurt has it.

So if you care enough to send the very best, just tell us your application. We'll do the rest. Lenkurt Electric Co., Inc., San Carlos, California.

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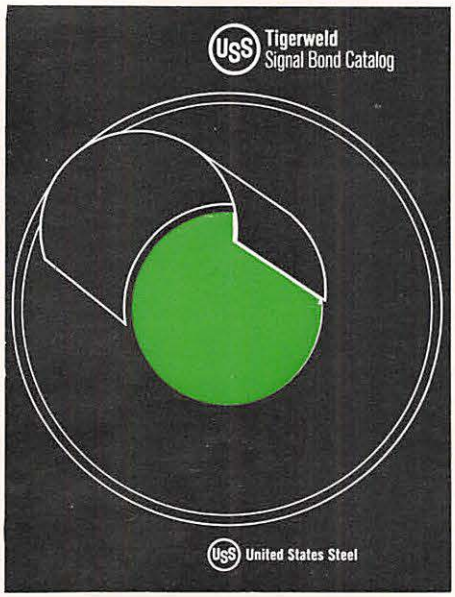

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This stretch may be too long!

Our new rail-mounted SERVOSAFE® Hot Box Detective™ prevents axle burn-offs and derailments.

It's a good thing to have on your railroad.

But, for safety's sake, don't stretch a good thing!

Do you have long stretches of track without SERVOSAFE protection?

Recent studies have revealed that such factors as heavier car loadings, faster train speeds and greater accelerations have combined to increase the incidence of overheated journal boxes. This has prompted many railroads to review their spacing of hot box detectors. Up to now, the average spacing has been 25 to 30 miles apart along line-of-road. Under today's conditions, however, a hot box can develop in less than 25 miles and cause a derailment *between* detectors.

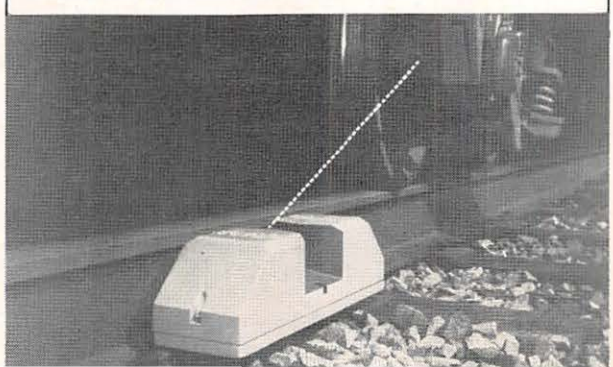
One solution becomes self-evident: closer spacing of hot box detectors for more protection. A SERVOSAFE system will not prevent a hot box—but it will detect, locate and warn of a hot box before the condition worsens into a dangerous, costly axle burn-off and derailment!

Will it cost you more to get this additional SERVOSAFE protection? Not really. Here are some reasons why not:

Our new Model 8808 SERVOSAFE system features patented rail-mounted scanners and solid state electronic data processing for the fastest, most precise detection of hot boxes. It allows remedial action to be taken *before* a failure occurs, and helps cut down the high costs of major salvage or replacement. The cost of installation and maintenance is appreciably reduced by eliminating the need for concrete foundations, special ties and expensive roadbed preparation. The rail-mounted scanner can be easily removed for maintenance or relocation. Finally, compare the cost of a SERVOSAFE with the $200,000 involved in just one derailment that could be prevented.

That's why most prudent, progressive railroad managements agree when we say, "More SERVOSAFE protection isn't costly—*lack of it is!*"

Model 8808 SERVOSAFE Hot Box Detective Rail-mounted scanner "looks" at journal bearing behind truck frame with a vertical, close-in target scan for greater uniformity and accuracy. Scanner is securely clamped to the rail (no drilling required). Accuracy is not affected by rail pumping, running or lateral movement.



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Serving Safety Through Science

Since 1957, more than 1,000 SERVOSAFE Hot Box Detective systems have been put into service on 54 of the world's major railroads, and have compiled an unequaled record of safety improvement and cost reduction.

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MEMBER RPI

News Briefs

● ANN ARBOR has received approval from the Federal Railroad Administration's Railroad Safety Board to install a traffic control system between Alexis, Ohio and Diann, Mich., 15 miles.

● BAY AREA RAPID TRANSIT DISTRICT approved the return of test-track laboratory cars to service for tune-up runs on regular BART tracks next spring. Westinghouse Electric Corp. which received a $26-million contract in May, 1967, for the BART system's automatic train control and communications equipment, will conduct the test runs. Authorization calls for the modification of two laboratory cars and equipping them to run automatic train control tests on BART tracks already in place linking Oakland to the present southern terminus at the South Alameda Yards near Union City. Exteriors of the existing laboratory cars must be reshaped so that the cars can clear the subways during the tune-ups. The purpose of the tests, Westinghouse officials explained, is to accelerate tune-up of the automatic train control so that the system will be ready when the prototype revenue cars arrive for testing one year hence. The laboratory cars also will be employed on the other lines of the system to help BART meet its plan for the start of revenue service. Meantime, checkout and programming continues at the automatic control operations center at BART's Lake Merritt headquarters in Oakland, and installation of local control equipment in the passenger stations has begun.

● FEDERAL COMMUNICATIONS COMMISSION is taking a look at ratemaking with respect to common carriers. In a notice of proposed rulemaking, FCC suggested that tariffs involving rate increases should be filed on 60 days' notice instead of the present statutory 30-day period. The intent of the proposed rules, the Commission said, is to reduce the number of tariff filings ordered for hearing.

● FEDERAL RAILROAD ADMINISTRATOR **Reginald N. Whitman** said recently that initial research by DOT and FRA will be in nine areas including human factor studies, braking systems, automatic train control, hazardous materials, derailment-causal/economic analysis, a central information system, and automatic train couplers. "A comprehensive research plan has been developed for each of these areas and we hope to begin work on them in the next fiscal year.

"Our objective in this 5-year grade crossing program will be: (1) to reduce grade crossing accidents by 25%; (2) to develop special devices which will help reduce accidents at grade crossings with low vehicle and train volumes; (3) complete accurate inventories and records of all grade crossings, accidents at these crossings, and costs so that we may better formulate future policies; (4) improve cost and benefit information as a basis for selecting improvement projects of merit; and (5) to carry out demonstration projects in several communities with the objective of eliminating unnecessary crossings and providing protection for all crossings which are allowed to remain," Whitman said.

● FLORIDA EAST COAST has received approval from the Railroad Safety Board, FRA, to install a traffic control system replacing automatic block signals between St. Lucie and Stuart, Fla., 26 miles.

● GREAT NORTHERN has received approval from FRA's Railroad Safety Board to install traffic control systems between Whitefish and Radnor, and Ripley and Troy, Mont., totaling approximately 49 miles.

● GREAT NORTHERN has received FRA approval to change from semaphore to color-light automatic block signals on 29-miles of line between Marysville and Mt. Vernon, Wash.

● MCI PACIFIC COAST INC. has applied to the FCC to provide communications service between San Diego, Calif. and Seattle, Wash. This is the fourth Microwave Communications Inc. associated company to provide special service common carrier microwave. Basic capacity of the new 54-station system, which will connect with Los Angeles, San Francisco, Portland, Ore., will be 72-channels. Previous MCI systems filed with FCC, include two systems between New York and Chicago and one system from Chicago to St. Louis.

● NEW TWX RATES which were to be effective Nov. 1, have been suspended until Feb. 1, 1970 by the Federal Communications Commission. Also, the Commission ordered a new, separate hearing docket on the new teletypewriter exchange service rates of AT&T. The Commission noted, according to *Telecommunications Reports*, that on the basis of information before it, it was unable to determine if the tariff filing would be just and reasonable. It issued an accounting order, directing that records be kept of payments made under the new rates if they are put into effect at the end of the three-month statutory suspension period. The FCC also commented on interconnection in regard to the TWX service stating "that the present TWX service offering does not provide for interconnection of customer equipment in the same manner and to the same degree as is presently provided in message toll tariff FCC No. 263. For example, it appears that under the message toll tariff the customer may provide his own modulating and demodulating unit (modem), while under the TWX tarriff offering this is not permitted.

"We believe serious questions are raised in view of the apparent limitations imposed presently in the TWX tariff as to the use of customer-owned equipment, and on our own motion are ordering that the lawfullness [the TWX tariff's interconnection regulations] be explored in this investigation."

● NORTHERN PACIFIC has received approval from the FRA Railroad Safety Board to change from semaphore to color-light signals in automatic block signal territory between Casselton and Peak, N.D. approximately 28 miles.

● PENN CENTRAL has opened an expanded and modernized Sharonville yard, near Cincinnati. The new yard has automatic switching for routing of cars with selective speed controls on electro-pneumatic retarders upgraded to handle 160-ton cars. PC's new computer-controlled automatic classification yard at Columbus, Ohio is expected to be placed in service early in 1970.

● RICHMOND, FREDERICKSBURG & POTOMAC has installed over 1,000 high-impact plastic insulators replacing glass units in the past year and a half on its 110-mile mainline. Made of an electrical grade polycarbonate resin, the Porter insulators weigh about 1.5 oz compared to 24 oz for an equivalent glass unit. "The difference in weight is tremendous, a feature that simplifies handling and installation, and is appreciated by the men who have to climb up the poles with them," reports W. E. Prince, Jr., engineer-signals and communications. "It is practically impossible to break the Porter insulators. We haven't found any broken ones yet, though we have found evidence of their having been struck." RF&P expects to save about $1,000 a year when replacement with all plastic insulators has been completed. "The new ones cost more initially than the old glass ones," says Prince, "but we are willing to pay more for a product that will last longer." Made by the Electrical Division of H. K. Porter Co., the insulators are in compliance with Communication & Signal Section, AAR, specification 1-A-33.

● SOUTHERN has applied to the Federal Railroad Administration for approval to discontinue intermittent inductive automatic train stop system on the following lines: Cincinnati, Ohio-Chattanooga, Tenn.,-New Orleans, La., 185.6 miles double track and 639.0 miles single track; Spencer N.C.-Howell, Ga., 170.6 miles double track and 133.4 miles single track; Atlanta-Macon, Ga.-Jacksonville, Fla., 12.8 miles double track and 334.6 miles single track; Stevenson, Ala.-Memphis, Tenn., 4.0 miles double track and 266.0 miles single track; Bristol, Tenn.-Citico Jct., Tenn., 51.0 miles double track and 187.0 miles single track. Morristown, Tenn.-Salisbury, N.C., 6.0 miles double track and 222.3 miles single track; Ooltewah, Tenn.-Atlanta, Ga., 13.2 miles double track and 124.6 miles single track; Charlotte Jct., N.C.-Columbia, S.C., 108.0 miles single track; Biltmore, N.C.-Hayne, S.C., 3.0 miles double track and 61.9 miles single track; Austell, Ga-Birmingham, Ala., 148.4 miles single track; Haleyville-Jasper,

(Please turn to page 32)

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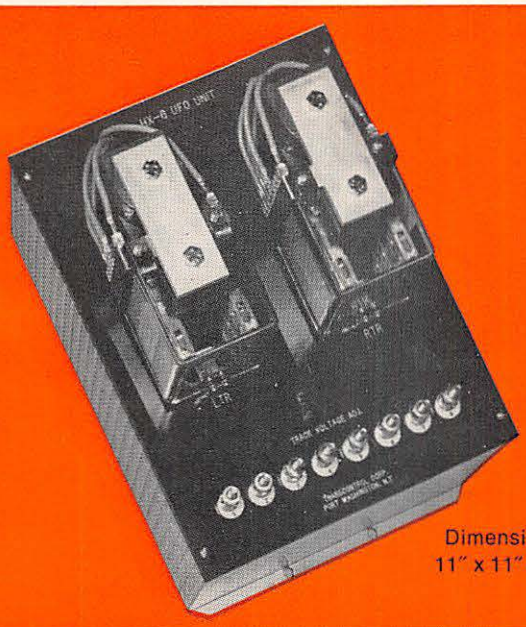

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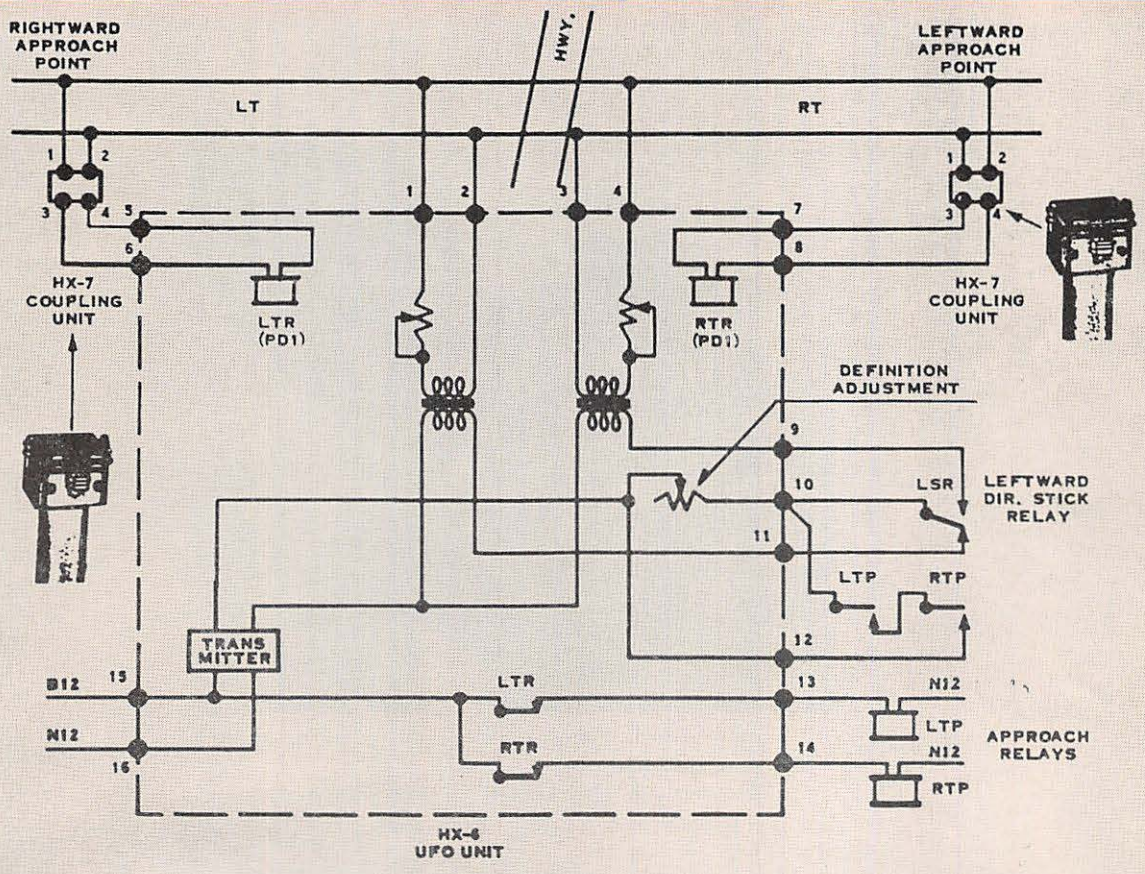
11" x 11" x 11"

TRANSCO UFO

(Unamplified Frequency Overlay)

JOINTLESS TRACK CIRCUIT
FOR HIGHWAY CROSSINGS
(patent pending)



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1. Energy in track circuit is well above noise level. No external energy required at output end.
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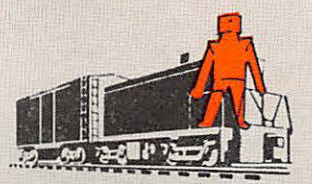

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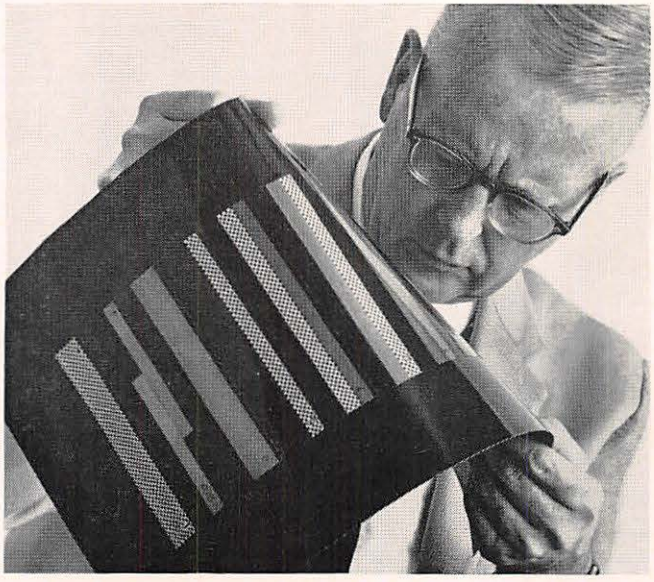
Some of America's smartest railroads are just learning to read.



In a few months, almost every freight car in the country will carry an ACI label.

A label that will instantly tell car type, owner, and number. To anyone who can read it. Even when it's rolling by at 80 m.p.h.

That's why some of America's smartest railroads are learning to read ACI labels. Railroads like the Illinois Central, MOPAC, CN, Santa Fe, CP, Penn Central, DM&IR have installed KarTrak* ACI System Scanner and Decoder units along their tracks and in their yards.

Their KarTrak ACI system came from Sylvania. Which is pretty smart, too. Because Sylvania developed the whole system in the first place.

With ACI labels offering all that information just for reading, this is no time to be illiterate. Get smart. Get KarTrak.

For technical details, write to Sylvania Information Systems, Commercial Electronics Division, Waltham, Mass. 02154

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GENERAL TELEPHONE & ELECTRONICS

*Trademark

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Maybe someday the other guys will have a guaranteed, million dollar reservation system like Max.

Maybe.

When the other guys reserve a car for you, they assume it'll be there. National *knows.* Because right now—today—National has Max, a million dollar computer.

Max knows the whereabouts of every car in our fleet. When you call us toll-free at 800-328-4567, Max tells us instantly what's available so we can guarantee your reservation.

Max isn't the only difference, either. National has GM cars, S&H Green Stamps and a trusting nature that prompts them to accept any recognized credit card at any of their 1800 locations.

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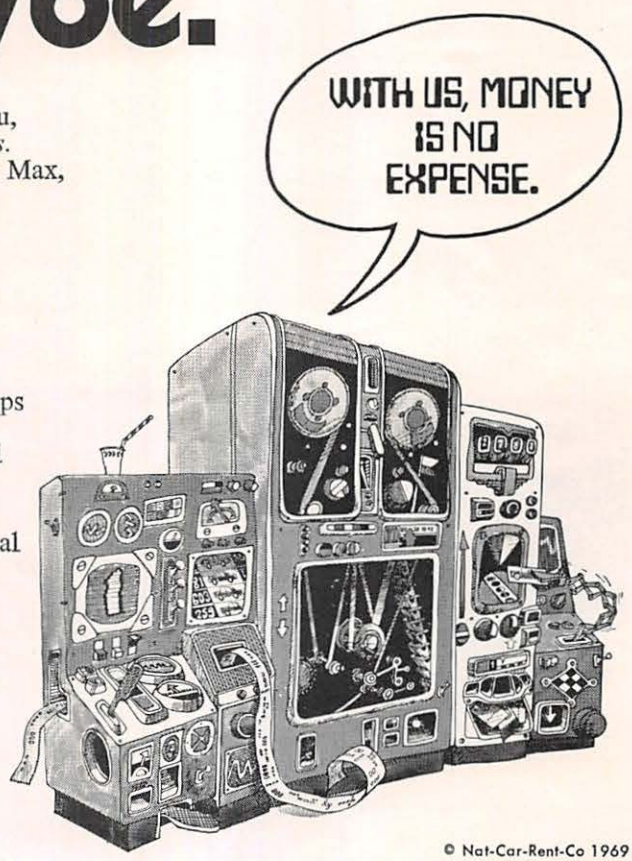

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WABCO

Circle 10 on reader service card

Charles J. Chamberlain was born at Ashton, Ill., on August 7, 1921. His grade and high school education was obtained in DeKalb, Ill. He began his railroad career with the Chicago & North Western as an assistant signalman in 1938. He was promoted to signalman in 1943 and to leadman in 1944, becoming a signal maintainer at Belvidere, Ill., in 1955. Mr. Chamberlain was appointed grand lodge representative in 1957, after having served three years as vice-general chairman of the C&NW BofRS general committee. He was elected BofRS secretary-treasurer in 1961. In August 1967, Mr. Chamberlain was elected president of the Brotherhood of Railroad Signalmen.

Skill counts says BofRS

Charles J. Chamberlain has been president of the Brotherhood of Railroad Signalmen for two years. In that brief span, he led the union's drive for a wage package that included recognition of skill differential pay. In addition to proposing new wage rates in a Section 6 notice to the carriers, BofRS may issue a notice after the first of the year calling for nationwide training. Mr. Chamberlain has taken on the added duties of chairman of the Railway Labor Executives' Association. In this exclusive interview, he discusses current problems with Gus Welty, senior editor, Railway Age, and Bob McKnight, editor, Railway Signaling & Communications.

Q. **What has been the response to your latest Section 6 notice to the railroads?**

A. Conferences have been concluded on the properties between our general chairmen and the railroads' representatives. Since then, the carriers have served additional counter-proposals to supplement their original proposals. Conferences will now be held on those additional proposals and we anticipate that this will be referred to us for national handling. The response that our general chairmen received from the carriers is typical of the response we've received from them for many years—there are no serious negotiations. Each side reads its notice, and they agree that they will be referred to their respective committees, and

that's all. It's strictly a formality. None of the general chairmen have reported to me that the carriers have said "it's ridiculous" as yet.

Q. How do you think you're going to come out on this latest wage notice? Are you going to come up to a screeching halt as on the last one, and your people threaten to walk off the job, or do you see a change in attitude?

A. Unless there has been a drastic change in policy in the thinking of the National Railway Labor Conference, I would predict we are going to be confronted with the same type of situation, because we are very determined, as we told Mr. Hiltz and the railroads the last time. It is kind of disheartening when you realize that we had about six hours of actual across-the-table negotiations over a period of 13 months. There was no face-to-face meeting with the carriers during the mediation process, not one. This is not the way to do business. The railroads know they have to negotiate with us, they might as well get to it. Why wait until the final day when you have to put a shotgun up to their heads?

Q. Do signal engineers sit in on these meetings with you?

A. No sir! The signal engineers do not, and we think it is most unfortunate. During the emergency board proceedings, they are there to testify, but not during the negotiations on the national level. The signal engineers may be somewhere behind the scenes, but we have never seen them.

Q. The way it looks to you now, does any one of the organizations seem to be out ahead in arriving at a settlement which will hereafter be referred to as the pattern?

A. Well, I don't know. I'm not so sure that as a result of what happened

Signalmen ask for wage increases over a three-year period.

The October 1969 wage notice of the Brotherhood of Railroad Signalmen is as follows:

A. ADJUSTMENT OF STRAIGHT TIME WAGE RATES: Increase all straight time rates of pay for employes covered by the agreement, applied so as to give effect to this increase in pay irrespective of the method of payment, by an amount equal to: 12% effective Jan. 1, 1970, 10% effective Jan. 1, 1971, and 8% effective Jan. 1, 1972.

B. ADDITIONAL ADJUSTMENT OF STRAIGHT TIME WAGE RATES PAID TO SKILLED EMPLOYES: Increase all straight time rates of pay provided for in Part A of this notice for Signalmen, Signal Maintainers, and all others occupying generally recognized mechanics' or higher rated positions covered by the agreement, applied so as to give effect to these additional increases in pay irrespective of the method of payment, by an amount equal to: 4% effective Jan. 1, 1970, 4% effective July 1, 1970, 4% effective Jan. 1, 1971, 4% effective July 1, 1971, 4% effective Jan. 1, 1972, and 4% effective July 1, 1972.

C. ADDITIONAL ADJUSTMENT OF STRAIGHT TIME WAGE RATES PAID TO SEMI-SKILLED EMPLOYES: Increase all straight time rates of pay provided for in Part A of notice for assistant signalmen, assistant maintainers, student signalmen, and all others occupying generally recognized assistant mechanic positions, applied so as to give effect to these additional increases in pay irrespective of the method of payment, by an amount equal to: 1½% effective Jan. 1, 1970, 1½% effective July 1, 1970, 1½% effective Jan. 1, 1971, 1½% effective July 1, 1971, 1½% effective Jan. 1, 1972, and 1½% effective July 1, 1972.

D. COST OF LIVING ADJUSTMENT: Wage rates established in accordance with Parts A, B, and C above shall be subject to a cost of living adjustment effective April 1, 1970, and each quarter year thereafter. Such cost of living adjustment shall be in the amount of one cent per hour for each three-tenths of a point change in the Bureau of Labor Statistics Consumer Index above the base index figure for December 1969, except that it shall not operate to reduce wage rates below those established under Parts A, B and C above.

E. ESTABLISH A UNIFORMITY IN RATES OF PAY: Effective January 1, 1970, the straight time rates of pay for employes covered by the agreement shall be adjusted to eliminate substandard wage rates and establish uniform minimum rates which will compare with those being paid by the eastern railroads.

F. COMPENSATION FOR EMPLOYES WHO ARE SUBJECT-TO-CALL: Where an agreement, rule, regulation, interpretation, or practice, however established, exists requiring an employe to notify management where he can be reached after regularly scheduled working hours and hold himself available for work subject-to-call, it shall be amended, effective January 1, 1970, to provide that such employee will be paid four hours at the pro rata rate for each regular work day and four hours at the time and one-half rate for each rest day or holiday that he is assigned to a position which requires him to be subject to call. These allowances are to be paid to all employees covered by the agreement irrespective of whether they are hourly, daily, weekly, or monthly rated in addition to any compensation they would receive under other rules of the agreement for working, traveling, waiting, etc.

G. INCREASE IN OVERTIME RATES AND ALLOWANCES: (1) Effective January 1, 1970, time paid for in excess of eight hours in a calendar day or in any other twenty-four hour period or in excess of forty hours or on more than five days in a work week, or on rest days, holidays, or vacation days shall be considered overtime and shall be paid for at twice the straight time rate except that, where agreements now in effect require payment at twice the straight time rate the rate shall be increased to three times the straight time rate. (2) Effective January 1, 1970, establish a rule that provides that employes notified or called to perform a service outside of regular working hours will be paid a minimum allowance of six hours at the double time rate for each such service. Time worked in excess of six hours will be paid for on the actual minute basis at the double time rate.

H. SHIFT DIFFERENTIAL PAY: Any employe who is assigned to work a shift the starting time of which is established between the hours of 2:00 P.M. and 6:00 A.M. will in addition to all other compensation payable under the agreement be paid an additional 20¢ per hour differential for the hours of such shift.

I. LONGEVITY PAY: All employes covered by the agreement shall receive longevity pay of 2¢ per hour per year longevity to a maximum of 50¢ per hour for employes with twenty-five years' longevity. Longevity pay shall be allowed in addition to the applicable rates of an assignment and will be paid for all work performed, including overtime. With respect to employes who on January 1, 1970, will have had a continuous employment relationship with the carrier for one year or more, longevity pay shall become effective on that date based upon the number of years of such continuous employment relationship then completed. Thereafter, with respect to all employees, rates of pay shall be adjusted on the anniversary date of the beginning of such employe's last continuous employment relationship to include the longevity pay herein provided for.

J. INTEREST ON RETROACTIVE PAY INCREASES: The first wage increases provided for in this notice shall be effective January 1, 1970, and should an agreement therefore not be reached by that date, interest on the retroactive pay increases shall be paid at the rate of three percent per month until actually paid.

the last time any of them are too anxious to be out first.

Q. **The last time it was the clerks, I believe?**

A. Yes, they did reach an agreement in a relatively short time. And this set the stage for some of the other ones. But the pattern doesn't recognize the problems of a particular craft. That is something Mr. Hiltz has got to recognize. Pattern may be all right for some organizations, but it certainly is not acceptable to the Brotherhood of Railroad Signalmen because we do have particular problems.

Q. **Would you rather negotiate on a railroad-by-railroad basis rather than on a national basis?**

A. It makes no difference to us, but because of the fact that we have contracts on practically all U.S. railroads, we believe it is to our advantage and to the advantage of the industry to negotiate on a national basis.

Q. **What I was thinking is that the the conditions or ability to pay might be better on a large railroad than on a small road.**

A. I think that you'll find reluctance on the part of an individual railroad to

Railroads issue counter-proposals to signalmen's Section 6 notice.

1. FORTY-HOUR WORK WEEK RULES: A. Eliminate all agreements, rules, regulations, interpretations or practices, however established, applicable to the forty-hour work week which are in conflict with the rules set forth in Paragraph B.

B. Establish a rule to provide that: (1) The normal work week of regularly assigned employes shall be forty hours consisting of five days of eight hours each, with any two consecutive or nonconsecutive days off in each seven. Such work weeks may be staggered in accordance with the carrier's operational requirements. (2) Regular relief assignments may include different starting times, duties and work locations. (3) Nothing in this rule shall constitute a guarantee of any number of hours or days or work or pay. (4) Work performed by a regularly assigned employe on either or both of his assigned rest days shall be paid for at the straight time rates, unless the work performed on either of the assigned rest days would require him to work more than forty straight time hours in the work week, in which event the work performed on either of his rest days in excess of forty straight time hours in the work week shall be paid for at the rate of time and one half. (5) Any overtime worked by the employee will be computed into straight time hours and be used for purposes of determining when he has completed his forty-hour work week but not for the purpose of determining when the time and one-half rate is applicable.

2. ENTERING RATES: Establish a rule, or amend existing rules, to provide that entering rates of pay shall be 80% of the established rates, with increases of four per cent (4%) of the established rate effective on completion of the first and each succeeding year of compensated service until the established rate is reached.

3. FORCE REDUCTIONS: Establish a rule, or amend existing rules, to provide that no advance notice shall be necessary to abolish positions or make force reductions.

4. MONETARY CLAIMS: Establish a rule to provide that no monetary claim based on the failure of the carrier to use an employee to perform work shall be valid unless the claimant was the employee contractually entitled to perform the work and was available and qualified to do so, and no monetary award based on such a claim shall exceed the equivalent of the time actually required to perform the claimed work on a minute basis at the straight time rate, less amounts earned in any capacity in other railroad employment or outside employment, and less any amounts received as unemployment compensation. Existing rules, agreements, interpretations or practices, however established, which provide for penalty payments for failure to use an employee contractually entitled to perform work shall be modified to conform with the foregoing, and where there is no rule, agreement, interpretation or practice providing for penalty pay, none shall be established by this rule.

5. DISCIPLINE AND INVESTIGATION: Amend all existing rules, agreements, interpretations or practices, however established, dealing with discipline and investigation in such manner so as to make the following effective: If it is found that an employee has been unjustly suspended or dismissed from service, such employee shall be reinstated with his seniority rights unimpaired and be compensated for wage loss, if any, suffered by him resulting from said suspension or dismissal less any amount earned, or which could have been earned by the exercise of reasonable diligence, during such period of suspension or dismissal.

6. HOLIDAY RULES: Eliminate all rules, regulations or practices that provide that when a regularly assigned employee on a position described as a 7-day position has an assigned relief day other than Sunday, and one of the holidays specified in this rule falls on such relief day, the following assigned day will be considered his holiday. Revise rules with respect to the birthday holiday to provide that an employee may be laid off on his birthday holiday and if the position is one that must be filled for the entire day, the work will be performed by such other employee as may be available at the straight rate of pay.

7. CONSOLIDATION OF SENIORITY DISTRICTS: Eliminate any restriction, however established, upon the right of the Carrier to consolidate seniority districts, in whole or in part.

8. REVISION OF TERRITORIAL LIMITS OF RESPONSIBILITY OR JURISDICTION: Eliminate any restrictions, however established, upon the right of the Carrier to eliminate, establish or adjust territorial limits of employees' responsibility or jurisdiction.

9. ABSORBING OVERTIME: Revise rules covering "absorbing overtime" so as to permit employees to perform duties of other positions where necessary.

10. GUARANTEE RULES: Revise guarantee rules to eliminate guarantee for positions.

11. TRAVEL TIME: (a) Revise travel time rules to eliminate travel time pay between 10:00 P.M. and 7:00 A.M. where sleeping accomodations are furnished. (b) Revise travel time rules to stop travel time pay where destination reached instead of paying to starting time of regular tour of duty.

12. GENERAL: All agreements, rules, regulations, interpretations or practices, however established, which conflict with any of the above shall be eliminated, except that any existing rules, regulations, interpretations or practices considered by the Carrier to be more favorable may be retained.

ATTACHMENT "A": (1) Eliminate all agreements, rules, regulations, interpretations or practices, however established, which restrict the Carrier's right to transfer work and/or employees across seniority district or craft lines. (2) Eliminate all agreements, rules, regulations, interpretations or practices, however established, which restrict the Carrier's right to rearrange forces and/or work on any shift or tour of duty to secure the most effective utilization of the available work force. (3) Eliminate all agreements, rules, regulations, interpretations or practices, however established, which restrict the Carrier's right to contract out work. (4) Establish a rule providing that during any work stoppage in any part of the railroad industry all bulletin, assignment, displacement, pay and protective provisions of any applicable agreements may be suspended by the Carrier for the duration of such work stoppage and employes will be assigned and compensated on a basis to be determined by the Carrier. (5) Eliminate Mediation Agreement, Case No. A-7128, dated February 7, 1965, and any similar so-called job stabilization agreements (excluding the "Agreement of May, 1936, Washington, D.C." and agreements entered into pursuant to Interstate Commerce Commission Orders in connection with merger, control or consolidation.)

set the pace in these negotiations regardless of ability to pay.

Q. Speaking of negotiations, I've had some signal engineers say that they support the BofRS wage demands and differentials for skills. But when asked to make their views known to the personnel or labor relations officers, they say: "it is not my province to negotiate labor agreements." What is your opinion regarding this situation, and will it change?

A. I heard a signal engineer at a Sectional meeting say: "I don't think we are being truthful to our management, because when we prepare our budgets we're not actually telling them what it's really going to cost to operate and maintain a first class signal department." The tendency on the part of most of them is to shade or trim the budget. I think railroad management wants to know what it is going to take to have a first class signal department that is going to permit them to move traffic in a safe and expeditious manner. Management wants to know, and I think it is the responsibility of signal engineers to tell them, just exactly what it takes to do that. It's going to cost some money, but once you get your maintenance and installation forces established, they make a large contribution toward making railroads a competitive form of transportation, second to none. But why signal engineers don't speak up, I don't know. Maybe they are afraid of their jobs. They are not organized. Maybe our next endeavor should be to organize the signal engineers and speak for them,

Q. There are some exceptions, for instance, in negotiating training agreements, signal engineers are speaking up. Do you find signal engineers helping you or introducing you to the personnel or training officers on railroads? Do the signal engineers invite you to go in with them to talk about training?

A. In talking about training, our general chairmen deal with the personnel people. We want the signal engineers in there so we can intelligently discuss training. Generally personnel people don't know much about signal training programs. The Santa Fe is a good example of cooperation of all concerned. We had the top officers of the Communications and Signal Department meet with our Vice President and general chairman and the personnel people. Because of this cooperation, we were able to reach an agreement. Generally, signal engineers don't invite us in to talk about training. We have to take the initiative in almost every case.

C. J. Chamberlain is chairman, Railway Labor Executives' Association.

Q. On how many roads do you have training agreements?

A. We have training agreements with the Canadian National, Santa Fe and Southern Pacific.

Q. Do you have an agreement with the Long Island?

A. We have just finished negotiating. A school is in operation, and our general chairman is one of the instructors. We have signed an agreement with the Long Island.

Q. Along the same line, do you have agreements on job qualification—that is, if a man passes tests, he is able to be promoted to a higher job clasification and increased pay?

A. This job qualification is an exception, rather than the rule. We do have some agreements covering job qualifications for electronic technician positions. The agreements provide that they must have a second class (or better) Federal Communications Commission radio-telephone license, and

pass certain tests that are prepared by the signal engineer and the general chairman. If they pass the tests, then they are qualified for those electronic positions. We go along with this, because we want the right people on these jobs.

Q. Then training and job classification is really an exception, as far as the total number of roads involved? Do you see any change in this?

A. Yes. I think the last Communication & Signal Section meeting (in Montreal) indicated to us that there is a definite desire on the part of some of the railroads at least to get into training. We certainly are going to do everything we can, perhaps even on a national basis, to do something about training on all the railroads. We always point to the Canadian National as the ultimate in a training program. We think this is one of the finest training programs that could ever be adopted on any railroad. If it can be done in Canada on the CN, then there is no reason why it cannot be accomplished on every railroad in the United States. It should be done, and it has to be done if the railroads are ever going to keep qualified personnel.

Q. Do you have in mind something in the nature of a formal apprenticeship program?

A. We're in the process now of working up a request that we'll be serving nationally, requesting the carriers to get into the problem of training. We'd do it on any road that we could, but we think it is of national importance. This is one of the next things that we are going to do.

Q. Do you have any specific proposals in the notice?

A. Yes, but our present plans have not been finalized. We are working on this.

Q. Will you serve it within a couple of months?

A. The timetable has not been set, but it will be sometime after the first of the year.

Q. Concerning training, you have probably heard the charge, "the union wants everything from the railroad. The railroad is to provide the facilities and instructors, pay for the training, train the men on company time and pay them for any travel and subsistence." What is the BofRS position on this?

A. We are not being unreasonable. The telephone and other industries train men on company time. They send men to school, pay their wages and subsistence. You can't train a person and at the same time require him to dig a ditch. A man can't look over his shoulder while digging and look into a relay case to see what is there.

Q. Do you see any improvement in the shortage of signalmen? Is the shortage going to continue? Do you think the impetus by the Federal government in the safety area can be of help in providing more signalmen?

A. The situation must improve because now it is at the bottom. It has only one direction to go, and that is up, because every railroad in the country has a backlog of work to be done.

Q. How has this been reflected in your organization membership figures since 1960?

A. Well, let's look at it from the standpoint of history. At our peak membership in the BofRS was 17,500 in 1952. Today, we have about 13,500 with vacancies on every railroad in the country. And if they had the forces that they need, our membership would go up. The potential is there to go up, not down. Railroads can't survive with fewer signalmen than they have in their present forces, they need more.

Q. Then you've done considerably better proportionally than maintenance of way?

A. That is correct. As an example, take an interlocking plant, say a mechanical plant, that requires 24 hours a day coverage. That means three employes around the clock plus a relief man. Now that plant is completely automated, made into an automatic interlocking, with nobody there. The payroll costs which have been eliminated result in a great savings to the carrier. The loss of jobs by automation has certainly hurt some labor organizations, but for our organization it generally results in another device for us to maintain. Another example is the Chicago & North Western crossing protection situation in 1956. C&NW had an annual payroll for crossing watchmen of $2 million. They called us in and asked us to sit down and help them expedite a crossing protection installation program. Management estimated that for $4 million it could completely automate all the manually protected highway grade crossings on its system lines. We were asked to temporarily relax some of our rules to permit them to take employes from the seniority districts where they didn't have too much work and bring them in to the Chicago metropolitan area. We made a term agreement for a year which benefited both sides and as a result the railroad was able to expedite the installations of the new crossing protection equipment. Again, the installation of the hundreds of automatic crossing protection resulted in many more devices for our members to maintain. While we benefited, maintenance of way lost many hundreds of people who were crossing watchmen. Proportionately, we have not suffered the employment decline that other organizations have, in fact, I think if the railroads are going to stay in business our membership will go up and exceed the peak that we had. That is the way it has to be.

Q. Are you working with any other railroads on similar special situations?

A. Yes, in just the last month on the Illinois Central. They requested that we consider establishing a system gang which would give them a mobile force of qualified people to take all over the railroad. Of course, we have divisional seniority districts on that railroad. They were willing to negotiate and we were successful in negotiating acceptable conditions for establishing positions on a system gang. We received rates of pay 15% above the current rates for the people on that particular system gang.

Q. Is this to be an installation crew or a maintenance crew?

A. An installation crew, primarily. We think this is a good agreement, because it certainly recognizes that our people are entitled to higher rates of pay. We also recognize that the carriers do have a problem regarding the flexibility of their construction forces and certainly the agreement negotiated by our representatives and management on that property indicates what can be done when both sides sit down and engage in sincere negotiations.

Q. Wouldn't this possibly be a forerunner to solving this crossing protec-

tion installation problem, such as you did on the C&NW? A road could build up an installation crew for crossing protection equipment and help cut the backlog in this area.

A. That's right. If a particular railroad is desirous of entering into sincere negotiations with our representatives on this or any other matter we are ready to talk with them. This is not to say, we are going to give away the rule book. Surely, to get an agreement requires dialogue between the parties. That is the key to the whole thing. Unfortunately, dialogue in the industry today is the exception rather than the rule.

Q. Speaking of work that belong to you, what is the situation with respect to automatic car identification?

A. In our maintenance structure in the industry our members are set up in maintenance territories. Such a set up provides a carrier with the best means of providing a force of qualified employes to handle ACI equipment. We filed notices on this over a year ago. First of all, our men are qualified. It is our understanding that the carriers can purchase ACI equipment outright or they can lease it. Whether the ACI equipment is purchased or leased, signalmen, because of their qualifications, subject-to-call rules and their close proximity to all installations by maintenance territories, unquestionably must be utilized by the carrier if the system is to be efficiently and effectively operated.

Q. In line with this discussion of skill, signalmen have been called composite mechanics. I wonder if some of the railroads realize that if they didn't have a signalmen's craft, how many crafts it would take to maintain a signal system? You have, of course, called attention to your situation as it involves skilled mechanics in your recent and upcoming negotiations?

A. Signalmen are truly composite mechanics. They can do just about everything. They are the first ones the carriers call regardless of the trouble. They know they can reach a signalman because he has to register with the carrier where he can be reached. He is called for just about anything.

Q. This whole business of compulsory retirement puzzles me. The labor movement generally is for the shorter work day, the shorter work week, we've got all this emphasis on leisure time. It would seem logical to me that the organizations would want retirement at 65 or even 60?

A. We are not opposed to compulsory retirement as such. What we are opposed to and what the organizations opposing House Bill 13300 object to, is retirement being imposed by legislation. Now maybe, someplace down the road, we will negotiate an agreement through the collective bargaining process with the carriers providing for compulsory retirement. If our members want that, and they indicate to us that they want that, certainly it will be an item for discussion and possible agreement by collective bargaining, but not through the legislative route. In our organization, we have three retirement agreements in effect right now covering 330 members out of our 13,500. Our 1967 convention in considering compulsory retirement proposals took no action. They did not endorse it, so our delegates have told us to lay off compulsory retirement. Congress has no right to invade the collective bargaining field, which they are doing now through House Bill 13300. If our delegates and membership tell us to get that type of agreement, we would do our best to obtain it, however, when that happens it will be as a result of a signed agreement across the bargaining table.

Q. Unlike at least one other organization, I imagine that you'll not be hurt too much by immediate retirements by a great number of people, if retirements were compulsory at 65?

A. I think in our last wage case we found that the average age of our membership was 42. I think that you will find that there are quite a number of signal employes within retirement range or who will be there shortly. I think we would be affected, as these are key people who have all the knowledge that goes toward making a good signal maintainer. With respect to our craft I think compulsory

Skills recognized on T&P

Agreement reached between the Brotherhood of Railroad Signalmen and the Texas & Pacific Railway in May 1968 provided for additional technician positions. The following job descriptions and promotion rule are abstracted from the agreement between the union and the railroad.

"Rule 1. (a) **Electronic Technician:** An employe assigned to the duties of inspecting, testing, repairing and replacing electronic signal apparatus and systems under the scope rule of this agreement. When required, he may in the performance of his duties supervise and instruct other employes covered by this agreement. This rule shall not be construed as prohibiting signal maintainers or other qualified signalmen from making tests, inspections and repairs as necessary.

"(b) **Retarder Yard Technician:** An employe assigned to the maintenance, adjustment, repair and replacement of electronic and electromagnetic components associated with automatic switching and automatic retardation of cars in retarder yard. When required, he may in the performance of his duties supervise, instruct and direct other employes covered by this agreement.

"(c) **Signal Inspector:** An employe who is assigned to the duties of inspecting and testing signal apparatus as defined in the scope rule of this agreement. This work shall include the testing of relays, interlocking, centralized traffic control installations, and insulation resistance tests. Other employes covered by this agreement will assist in making such tests and inspections when necessary. This rule shall not be construed as prohibiting signal maintainers from performing other routine tests and inspections as required.

"(d) **Foreman:** An employe who is assigned to the duties of supervising the work of a gang of other employes classified herein shall be classified as a foreman. When the number of employes supervised exceeds five, the foreman shall not be required to regularly perform work over which he has supervision.

"(e) The positions of electronic technician, retarder yard technician, signal inspector and foreman will be bulletined. In filling these positions, consideration will be given to employes in service in order of seniority, the management to be the judge, subject to Rules 40 and 50 (i)."

"Rule 40. Promotions to positions within the scope of this agreement shall be based upon ability and seniority; ability being sufficient, seniority shall govern. The ability sufficient for promotion to positions of electronic technician, retarder yard technician, signal inspector or foreman shall be determined by an examination given during regular working hours by the signal engineer or his representative. The examination shall consist of 50 questions from a list of 200 questions previously agreed upon by the signal engineer and the general chairman. The senior employe who makes a minimum grade of 80 on the examination will be promoted. Applicants for positions of electronic technicians and retarder yard technicians must have a Federal Communications Commission license, second class or better."

retirement would be harmful to the industry, because of the large shortage of skilled signalmen right now on every railroad in the country.

Q. Would this update signal equipment on some of the railroads because there would be no one to maintain some of the old equipment, say a mechanical interlocking?

A. That is correct. As an example cutting locking on a mechanical plant requires a great deal of skill and not too many employes in the industry today have had the opportunity to acquire this skill because mechanical interlocking plants are rapidly disappearing from the scene. Generally speaking, I would venture to say that there are not too many locking cutting experts employed in the industry today. Contrary to what Mr. Hiltz (chairman, National Railway Labor Conference) says that there is nothing to these mechanical plants—just throwing a lever back and forth—there is a lot more than just what appears on the surface.

Q. I take it then that you feel there is a selling job to get others to recognize the skills required of signalmen?

A. Right. You walk up to the average man on the street and ask him what a signalman does, and he will likely say he is a man who stands at a crossing waving a lantern or a stop banner. We have a selling job to do with the general public, and unfortunately we have to sell the railroad industry too. Not all of it, but top management that we deal with on the national level. We are going to keep plugging away until we get recognition of the fact that we do have a skill and are entitled to commensurate rates of pay for the important part we play in making the railroads a competitive form of transportation which is so essential to the economy and welfare of the United States and Canada. It is going to be a long haul, but I'm a firm believer in the potential of the railroad industry. I believe that mass transportation is the only answer. The answer is not building more expressways as the costs are prohibitive and the land can be used to better advantage for the benefit of our expanding economy. It took 12 years to build the Kennedy Expressway in Chicago, and the day they opened it up, it was taxed to capacity. The railroads are here, they have the physical plant to do the job. All that is required is an aggressive management who believes in the potential of the industry and is determined to do something about it.

Q. Do you see any general improvement in the management side or in the signal engineer's office in this general area of understanding? Do you see some of the bright young lads moving into positions of responsibility?

A. Yes. I go to a Communication & Signal Section meeting and I see people who are former members of our organization who have moved into management positions in C&S departments on the railroads. It is good that the industry is recognizing the great potential in the younger men. Some of our members, many who were local officers of our organization, are now officers of the railways and I think I know these people well enough to say that they have similar beliefs as ours and, subject to limitations that they have because they are working on the other side of the table, they are going to do everything they can to improve the situation.

Q. I don't believe there's too much any more of the carrier promoting the union officer into a management job just to get him out of the union?

A. No, I don't think so. I think they are promoting these people because of their ability and their knowledge. Of course, we have mixed emotions about such promotions for selfish reasons as we hate to lose good local and general committee officers, however, we are glad when these fellows can improve themselves. If we could only get practical men with signal experience and background who know our problems on the other side of the bargaining table, talking to us and if top management would listen to these people, I think the situation would be improved tremendously. Unfortunately that is not being done now except in emergency board proceedings and then it is only for the primary purpose of requiring them to play the role of a hatchet man to downgrade the craft. In our recent wage movement, it was quite apparent to us that the top negotiators for the industry were having a difficult time getting witnesses to take on this undesirable role because those who were called on to testify did not make any statements that were designed to mis-represent the truth about the skilled signal employe and his craft. I'm sure that there are those both in the industry and outside the industry who are looking at our organization with a kind of wondering eye as to what we have in our minds and how determined we are. You know, some people think that we are blowing a lot of smoke, but that is not the case as the future will bear out.

Q. If you will for a couple of minutes, philosophize on the new Railway Labor Executives' Association and its new chairman, and what he has in mind for it?

A. I'll say this, regardless of what happens the withdrawal of two or three unions will not mean the end of the RLEA. The organizations that are still in the Association will keep it in business, and it will be an effective organization. With respect to the financial aspect of it, certainly when you take out a group that makes a substantial financial contribution to the operation, you are going to be affected. However, with the determination, desire and dedication of the officers of the organizations that remain in the RLEA to do a job, I have no fear about RLEA being an effective organization. It may be even more effective than it was in the past. Mr. Leighty (president of the Transportation Communications Union) was chairman for a number of years, and he did a tremendous job. I do not think the capabilities, talents and resources of all the organizations within that Association were utilized to their fullest extent. That will be done in the future because every organization that is affiliated can and will make a contribution. What has happened in the past, I suppose, has come about because some were willing to just sit by and let "George" do it. We would look upon the RLEA operation the same as we do upon our own organization. Ours is a small organization, one of the smaller ones, but all the officers are really "working" officers. They are full time people, and they do that little bit extra that makes for an effective organization. We certainly have no fear about the future operation of RLEA. We are going through a period of a generation change in the railroad labor family. The younger fellows are becoming officers. They are a more militant group, there is no question about it. There are going to be differences of opinion during this transition period between some of the older ones and some of the younger ones. However, the differences are not so great as to be fatal to railroad labor. I am very optimistic. Naturally I don't like to see any organizations leaving RLEA, but that is their decision to make, and they are certainly free to do so. Such action certainly is not going to spell the end of RLEA.

Studies are required

Although most railroads are well along with labeling of freight cars in the interchange fleet, work is proceeding more slowly on determining where automatic car identification scanners may be used. Also, some railroads are in the position of not having development sufficient plans to really implement ACI. For example, the question must be answered—what use is made with ACI-generated data? To help those who desire more information about ACI, this article plus a bibliography are offered for guidance. The bibliography begins on page 31 of this issue. Some of the following material is from a report to the American Railway Engineering Association by its Committee 16—Economics of Railway Location and Operation.

When making a study concerning the possible applications of ACI, it is advantageous to form a study team with representatives of the operating, data processing, signal and communications, and industrial engineering departments. It is essential to have on the team a representative of an ACI equipment manufacturer.

The operating man will be in a position to evaluate how a certain location would relate to other locations in terms of traffic flow, interchange and industry moves. The data processing man can bring a knowledge of data format, handling and processing to the study team. The signal and communications representative, being knowledgeable about track circuits, power and communications lines relating to the scanner system, can determine these requirements and also what output interface should be used at each location. The industrial engineer with his knowledge of analytical techniques can determine the benefits and savings that result from the installation of an ACI project. The manufacturer's representative can aid in site and equipment analysis and selection.

One of the first considerations of the study team is to determine which applications justify an ACI installation. Is ACI to provide an audit check of car initials and numbers? Is ACI to provide data on inbound and/or outbound consists at yards and terminals? Is it to be used to provide passing reports, switch lists or interchange data? Will ACI be used for train identification? Will it be used to provide basic input to car movement systems?

There are several special applications where ACI may be used which should be considered. For identification of trailers, containers and tractors in a TOFC/COFC terminal, ACI can provide a type of check-in/check-out system. Should ACI scanners be installed at the crest of the hump to provide identification of cars classified? Should ACI scanners be located at pull-back tracks to give data on train makeup? Will ACI scanners be applied at rip track leads? Will ACI be used in conjunction with a weigh-in-motion scale? Will ACI be used with hotbox detectors, clearance or loose wheel detectors? Will ACI be used at a joint facility to provide data on train moves to relate to user charges? Will ACI scanners be installed at locomotive service area leads? Will ACI scanners be located at car and/or locomotive repair shop leads?

The possibility of using means other than ACI of providing the data should be considered. The following questions should be applied to each proposed scanner location: Are manual methods of checking initials and numbers sufficient? Is there really any need for checking? Can checking be accomplished by use of TV or video tape recording?

At this point in the study, it should be determined whether ACI will be of benefit to improve operations.

LOCATING SCANNERS

By now the study should indicate the general areas of locating ACI systems, based on mainline traffic flows, unit trains, interchanges, industries, yards and classification tracks. After tentative general areas for locating scanners are determined, actual site investigations should be made. At this point, local operating personnel should be included. A superintendent, his assistant, a terminal trainmaster or someone else at this level of supervision who knows the local operation should accompany the field survey group to the locations in his area. During these site investigations, the proposed locations of the ACI scanners hould be determined. An ACI site survey work sheet contains information helpful to the on-site inspection group.

Track configurations will often dictate scanner placement. A study of train moves will often indicate the most advantageous place to locate a scanner. Specifics on scanner placement were discussed in "ACI: Where does it stand?" published in *Railway Signaling & Communications*, September 1969, pages 23-25.

A cost-benefit type of economic study should be made of the various ACI configurations, including the various types of communications facilities and options that may be provided. Such an analysis should be made of each scanner location proposed. In this manner, various trade-offs can be determined. The analysis should be detailed and cover such items as power, communications, installation costs, maintenance costs, training of user personnel and maintenance personnel, etc. Also, cost-benefit analysis should consider leased vs purchased ACI systems, communications facilites and services, etc. All alternatives should be carefully studied.

The elimination of physical car checks is an obvious saving. Correct input to a data processing system is another meaningful saving as many cars which show on exception reports as being excessively delayed are simply cars entered under incorrect numbers. Studies have indicated that it costs about $10 each to clear open car records. Further savings can be found in automatic preparation of advance consists.

With the inclusion of routing information for no-bill cars, a savings can be realized. Even in a non-computerized system, a manual comparison of an advance list with an ACI-generated list can detect no-bill cars and allow the bill rack clerk to start locating missing waybill information well in advance of the arrival of the no-bill car. The savings that result from keeping a car out of the hold track include one day's per diem, as most hold tracks will sit for approximately 24 hours between pulls. The elimination of delay to the hump or to flat yard classification and customer satisfaction, even though the latter is intangible, provide worthwhile savings. Automatic preparation of interchange records can produce savings over the present manual method of handling interchange.

An ACI scanner cost and site selection program has been developed by W. H. Jewett, manager of management information systems, Soo Line. It is a computer model program. The inputs are train routes, movements and volumes, and ACI scanner location costs. The output is in a cost-per-scan format and provides a means of evaluating and establishing scanner installation priorities. The program (written in COBOL) is operational on an IBM 360 model 40 computer.

to determine economics of ACI

Studies by several railroads of specific ACI systems have indicated a 100% return on the investment in the first year. Many railroads are finding that a return on the investment within a 3-year period is not at all unusual.

ACI ECONOMICS

ACI installed at entrances and exits of yards can verify the cars and their position in the train. For the yard forces, this will permit the entrance to receiving tracks and departures to be made at normal operating speeds. The ACI-generated information will flow directly to the users as verified information. Direct labor savings are possible by elimination of inbound and outbound manual checking. The normal operating speeds will reduce initial and final terminal delay payments to road crews. With ACI verifying the cars as they are pulled from classification yards, the speed can be increased from 5 to 15 mph. This will reduce switch engine time for each track pulled and can result in actual elimination of yard crews.

ACI can replace the wayside TV scanning systems that are currently used for visual verification of cars. Discontinuance of TV systems and clerical personnel used to observe and record car movements will more than offset the expense of ACI systems.

ACI can be used to make the complete record for cars and locomotives moving over joint track arrangements. This will eliminate the need for personnel to maintain such records as the input would be mechanically processed for joint facility billing.

ACI can be used to verify and print out necessary information concerning interchange of cars. This will replace clerical personnel on the two roads involved as the ACI input would accurately serve both receiving and delivering carriers.

ACI can be used for billing purposes where high volume of cars of the same commodity are billed. Car numbers and weight from coupled-in-motion scales can be passed directly to computer systems for preparation of waybills completely void of manual effort. Clerical personnel used in the weighing and billing processes can be eliminated.

One railroad reports 18,000 to 21,000 initial unmatched car records each month. The cost of a closing these records amounts to approximately $2 million per year. Conservative estimates are that the accuracy, completeness and timeliness of ACI-generated inputs would reduce open car records upwards of 75%. Based on protecting 70% of the on-line volume of 106,000 cars, this road estimates that ACI could produce savings of $1.4 million annually.

Improved car utilization comes through timely, accurate data on car movements. While not talking for "print", many railroad data processing officers are concerned with the distortion currently existing in all computer data bases due to manual input. Many roads are using excessive personnel to manually audit computer output to clean up reports so they can be effectively used.

Using ACI-generated data, these problems could be eliminated. Most railroads using computer car control systems estimate that utilization can be improved 5 to 10% as a result of securing error-free control reports. Also, 18 to 20 data audit persons could be reduced.

Many men who have made cost-benefit analyses of ACI systems and proposed installations, agree with AAR's Data Systems Division Ad Hoc Committee on ACI which recently reported: "The original justification for Automatic Car Identification remains unchanged as the rate of increases in labor are matching and promises to outstrip the increased equipment cost."

ACI Site Survey Worksheet

RAILROAD_____

Location_____

Address_____

Date_____

RAILROAD PROJECT NO._____

SKETCH - Include Dimensions

PHOTO NO._____

SITE DATA

Power_____ft.- overhead, underground

Track Ckts?_____

Communications_____Ft.-RR., Bell

Max. Train Speed_____mph

Soil Conditions_____

Access Road_____

Nearest Telephone_____

EQUIPMENT

Scanner Heads_____

Decoder Units_____

Wheel Counters_____

Cable_____ft.

Housings - single_____Double_____

OPTIONS (CHECK OPTIONS REQ'D)

Carrier Index_____
Format Control_____
Message Generator_____
500 Label Buffer_____
1000 Label Buffer_____
Calendar Clock_____
Clock Battery_____
Duplexer_____
Multiplexer_____
Teletype_____
Data Sets (model)_____
Computer Equipment_____

OUTPUT INTERFACE (Circle)

TTY 83B 1050 85A ASCII

OUTPUT LOCATION & INFO. FLOW:

NOTES (Include special Engrg. items):

How to protect against surges

By Norman A. Bolton
Advanced Project Engineer
General Railway Signal Co.

If the equipment to be protected formed a small simple system, it could be placed all in a small housing with the inputs and outputs protected by suitable arresters and grounded to a prime ground terminal. Such an arrangement would provide good protection and only that system would have to be considered. However, there are few such simple systems on the railroads. Housings range from small junction boxes through cases and bungalows to large and very complex towers or buildings. These housings contain many systems and subsystems of various degrees of complexity and refinement. They all have one thing in common though, they all have to be connected and interconnected to perform the desired tasks. These connections require wires, hundreds of them in some cases, and these wires are run in wire chases or cable raceways. It is here that troubles begin. It is very difficult to prevent coupling from causing noise and interference among the circuits. This condition is further aggrevated by the fact that some wires may carry surges because they extend out of the protection of the housing and its prime ground terminal to remote locations which are either exposed to lightning or the variations of potential of some other prime ground terminal.

It is seldom possible to consider each circuit from the standpoint of every other circuit with which it is, or with which it may become, associated. Therefore it makes sense to adopt a standard with which every system or subsystem can be made compatible and by so doing, obtain systems which can each work with every other. Of course there may be systems which by their nature defy conformance with this standard. When this is the case it is obvious that very special precautions will have to be taken for that system.

One way of setting up such a standard is to realize that for every piece of equipment there is a surge or transient environment in which it will be perfectly safe and to which it will not contribute transients of a greater level. This particular transient environment can then be said to have a particular transient level. If all the equipment in the housing is then divided according to the transient levels in which it can survive and to which it will not contribute any greater transients, that equipment can be placed in the same racks if necessary and the wires can be run in the same chases. The equipment will then last its normal life and operate without interference. When it becomes necessary for equipment in one transient level to be wired to equipment in another transient level, some device must be used to reduce the transient level to protect the equipment at the lower transient level. This device or a number of these devices is known as an interface.

The transient levels can only be kept to their assumed maximums if the wires that lead between them are equipped with apparatus to reduce at the interface any transients which might be following them. Such apparatus might consist of a lightning arrester, R-C or LC filter, relay or zener diode depending on the level involved. The wiring of any such interface must be designed to prevent the higher level from mixing with the lower level after the reduction has been made. This necessitates wiring the two levels in separate cables and maintaining adequate separation between these cables so that coupling does not occur and negate the reduction achieved by the interface device. It also means that the equipment of the interface must be designed to have physical separation between its high level and its low level. When interface devices are wired properly, a reduction can be gained but this reduction will always be limited by the proximity of the high and low level wiring. Consequently it would not be practical to try to obtain all the reduction in transient level at one location. For example, it is highly unlikely that sufficient reduction and separation can be obtained at one location to allow lightning surge currents at the high level and reliable integrated circuit operation at the low level of the interface. Actual physical distances must separate equipment of such dissimilar sensitivity.

One more factor must be considered before any division of the circuits of a complex installation is undertaken. That is, that it is useless to reduce at any interface, any transient level below that which will be encountered in the normal operation of the equipment of the low level. Taking these factors in to consideration then will allow the establishment of suitable transient levels which are convenient, effective, and not prohibitive in cost. Consideration of these levels during system design will also help to insure a practicable solution to the transient protection problem.

All circuitry can be divided into the four transient levels that follow. Note that the divisions also reflect the normal operating levels of the equipment for which the circuitry is designed. These transient levels may be designated: unlimited, power, supervisory, and computational. Each has a maximum operating level and a maximum transient level. Figure 12 shows a table with a heading for each of these levels and lists some of the equipment included at each level.

This unlimited transient level contains all the outdoor equipment which is exposed to direct or indirect lightning and all of the conductors which connect them for power, signaling or communication purposes. It contains the rails themselves, locomotives, track mounted equipment, cases, bungalows, signal masts, towers, buildings, antennas, antenna towers, pole lines, and underground cables. Maximum lightning surge currents of over 200,000 amperes can be present in any of these items. The only restriction that can be placed on any of these items from a lighting protection standpoint is that it should be able to conduct a direct stroke from its upper extremity to ground without damage to itself. In the case of single wire conductors, this means that it should have at least the conductivity of a #8 copper conductor. In the case of multi-conductor cables,

Editor's Note: This is the second part of a two-part series on lightning protection for signaling and communications equipment. The first part, describing the nature of lightning, was published in the November 1969 issue on pages 22-29.

TRANSIENT LEVEL	UNLIMITED	POWER	SUPERVISORY	COMPUTATIONAL
MAXIMUM OPERATING VOLTAGE	NONE	600V	50V	15V
MAXIMUM TRANSIENT LEVEL	NONE	2000V	100V	30V
SUGGESTED WIRING	HEAVY CONDUCTORS OR HEAVY SHIELD	BLACK INSULATION #6 TO #14*	GREY INSULATION #18 TO #22*	WHITE INSULATION #20 TO #28*
NAMES FOR INTERFACE	NONE	ENTRANCE ARRESTERS TOWER ENTRANCE RACK BUNGALOW ENT. RACK	POWER RACK CONTROL ROOM ENTRANCE RACK COMPUTER ROOM ENTRANCE RACK	COMPUTER TERMINALS OR "STICK"
USUAL EQUIPMENT	OVERHEAD LINES OVERHEAD CABLES UNDERGROUND CABLES LIGHTNING RODS GROUND RODS RAILS ANTENNAS	POWER TRANSFORMERS LIGHTNING ARRESTERS 110V AC POWER ELECTRO-MECHANICAL EQUIPMENT SOME POWER TRANSISTORS AND RECTIFIERS MOTOR-GENERATORS LIGHTING HEAVY DUTY RELAYS POWER SWITCHBOARDS MOTORS & FANS	CONTROL SWITCHES INDICATOR LAMPS REED RELAYS CONTROL MACHINES TEST PANELS AMPLIFIERS TRANSMITTERS RECEIVERS RUGGED TRANSISTORS 28V AC OR DC POWER POWER SUPPLIES TELEPHONES	COMPUTERS INTEGRATED CIRCUITS SENSITIVE TRANSISTORS

* NOT INCLUDING GROUND OR POWER DISTRIBUTION WIRES WHICH WILL BE HEAVIER. TWISTED AND/OR SHIELDED AS REQUIRED BY CIRCUIT.

Figure 12: Chart showing the four transient levels and their characteristics.

the shield or overall braid should have at least that conductivity.

This power transient level utilizes the first transient reduction. It is generally effected by lightning arresters, which conduct incoming surges to ground. Both the incoming wires and the ground wires will carry very heavy surge currents and they must be kept separate from the wires extending from the arresters on into the protected equipment. Some equipment can be mounted adjacent to these arresters and function in that environment. This equipment includes such items as AC power and lighting transformers heavy electro-mechanical equipment, heavy duty relays, power switchboards, and most 110 volt AC operated equipment.

Such things as power supplies which have 110 volt AC inputs and low voltage DC outputs generally have good transient reduction capabilities and advantage should be taken of this fact by mounting them at the interface to the supervisory transient level so that the low voltage wiring can be kept separate from the 110 volt AC wiring. The same holds for low voltage AC transformers used to power equipment in that level. Twisting both sides of the circuits on the inputs and outputs of such transient reducing devices will help to maintain the reduction inherent in the device.

Arresters used for the power transient level should break down at about 1000 volts so that any overshoot caused by delay in ionization will still be well under the 2000 volt maximum set for this level. Arresters of less than 1000 volts are probably unnecessary because much of the equipment itself, operating in this level is capable of producing transients up to 2000 volts. Note that if lower voltage arresters were used, the inbound wiring from them would have to be kept separate (in another wire chase) from the remainder of the wiring of this level, if any advantage is to be taken of the lower breakdown voltage.

Since some of the equipment in this level and in the unlimited level operates at voltages above what is safe for the human body, and since it has transient voltages far above human tolerance, it would be well to equip housings for this equipment with a sign warning of the hazard. This is especially true in buildings where personnel are employed for non-electrical purposes, and who could not be expected to understand the danger. Such a sign might read:

WARNING: HAZARDOUS VOLTAGES MAY BE PRESENT!

It should be affixed to each rack holding equipment in these levels.

In this supervisory transient level is found the equipment that relates to operation by personnel. Any equipment associated with normal 24 hour a day operation by people without special safety precautions should be at this level for safety. Such equipment as telephones, control panels, switches, indicators and the like are all included in this level. In addition some logic function equipment and electronic circuitry can be included at this level but it must be capable of withstanding transients up to a maximum of 100 volts. Reasons for having such equipment included at this level are that it doesn't have to be interfaced and built to withstand the transients of the power level or that it doesn't have to be interfaced for operation at the more sensitive computational level.

In this computational transient level,

For every equipment there is a surge environment in which it will be perfectly safe.

transistor or integrated circuits can operate for their normal long lifetime, free of the disrupting influence of lightning surges; or transients from the normal operation of heavier equipment. All of the wires extending into or away from this equipment must pass from the supervisory level through this final interface, for reduction to the low level which such equipment requires. Operation at this level is justified when the amount of logic to be performed can be accomplished at a cost which when including the interface, is less than the cost of doing the same thing at the supervisory level. Digital computers and some forms of electronic equipment operate at this level.

When many racks of equipment are connected in one complex assembly, great difficulty will be experienced in trying to keep all the ground leads short and running directly to the prime ground terminal. The organization of the equipment into transient levels provides a fortuitous solution to this problem. Figure 13 shows an arrangement of interface racks and their ground connections. Here the prime ground terminal is located adjacent to the incoming cables at the entrance rack where the arresters for the power transient level are located.

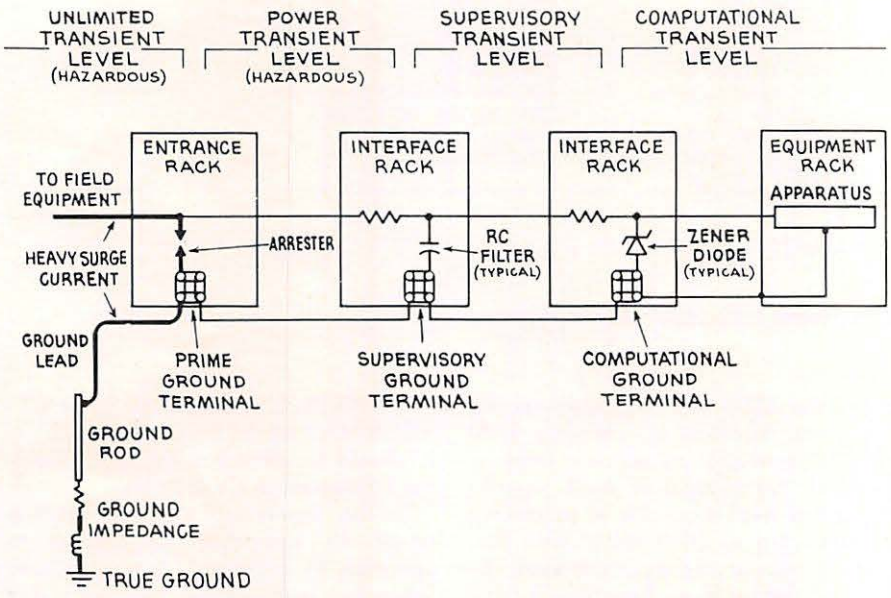

Figure 13: Arrangement of ground connections in electronic installation.

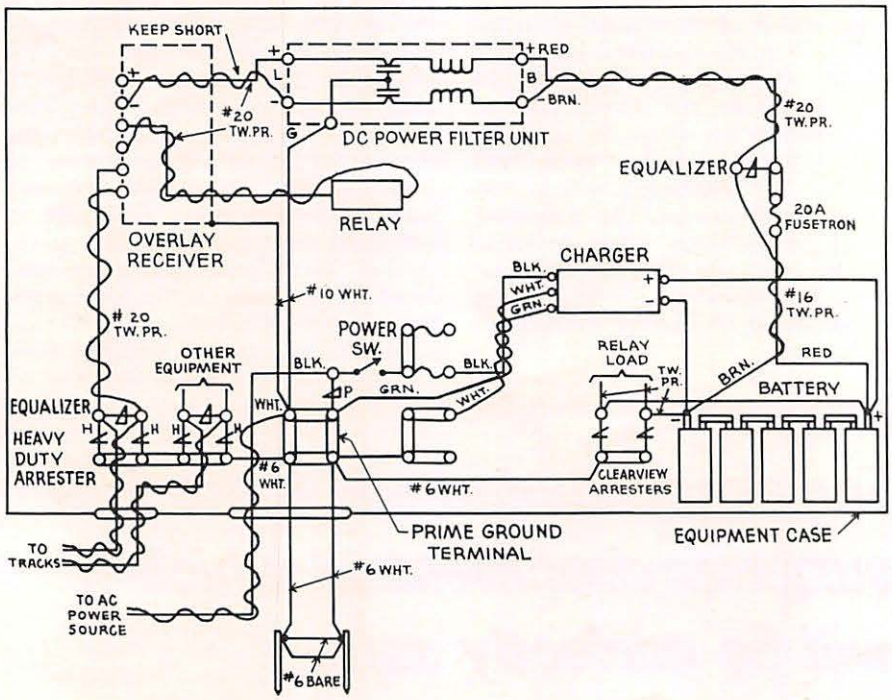

Figure 14: Arrangement minimizes surge interference with overlay units.

At this location, all the very heavy surge currents can be contained in wires that can be kept short. All equipment in the power transient level will also be grounded to the prime ground terminal.

From the prime ground terminal a heavy wire such as a #1/0 can be run to the interface rack (s) for the supervisory transient level. Here an auxiliary ground terminal is established which could be called the supervisory ground terminal. To this terminal will be connected all ground leads from the interface and equipment of the supervisory transient level.

From the supervisory ground terminal another large conductor is extended to the interface rack (s) of the computational transient level. Here another auxiliary ground terminal is established to which are connected all of the ground leads of the interface and equipment of the computational level.

This arrangement of one main and two auxiliary ground terminals provides a system whereby equalization can occur as if a single terminal were provided and where currents in the ground leads are confined to areas where such currents can be tolerated. At the same time there is an adequate ground where it needs to be. Care must be exercised however to insure that the ground path is not circumvented or bypassed by metallic connections between racks, conduits or wire chases of the various levels. (Actually, a separate area or room could be designated for equipment of the first two levels. This would allow physical separation to prevent accidental misconnections of grounds and the additional benefit of separating the hazardous and non-hazardous equipment so that personnel operating the non-hazardous equipment will not be endangered).

The drawing of Figure 13 also shows an example of a single lead coming in to the most sensitive equipment from the field. Note how at every interface rack the transient level is reduced to the level of the wires with which it must be run until finally it is reduced to a level which the most sensitive equipment can withstand. Furthermore at no place does it have a transient level that will interfere with any other equipment. Note in passing, the similarity of this drawing with that of any standard multi-stage filter circuit.

Any system then, can be treated in this manner. The most complex; as shown, and simpler systems with simplification of this basic idea, allowing

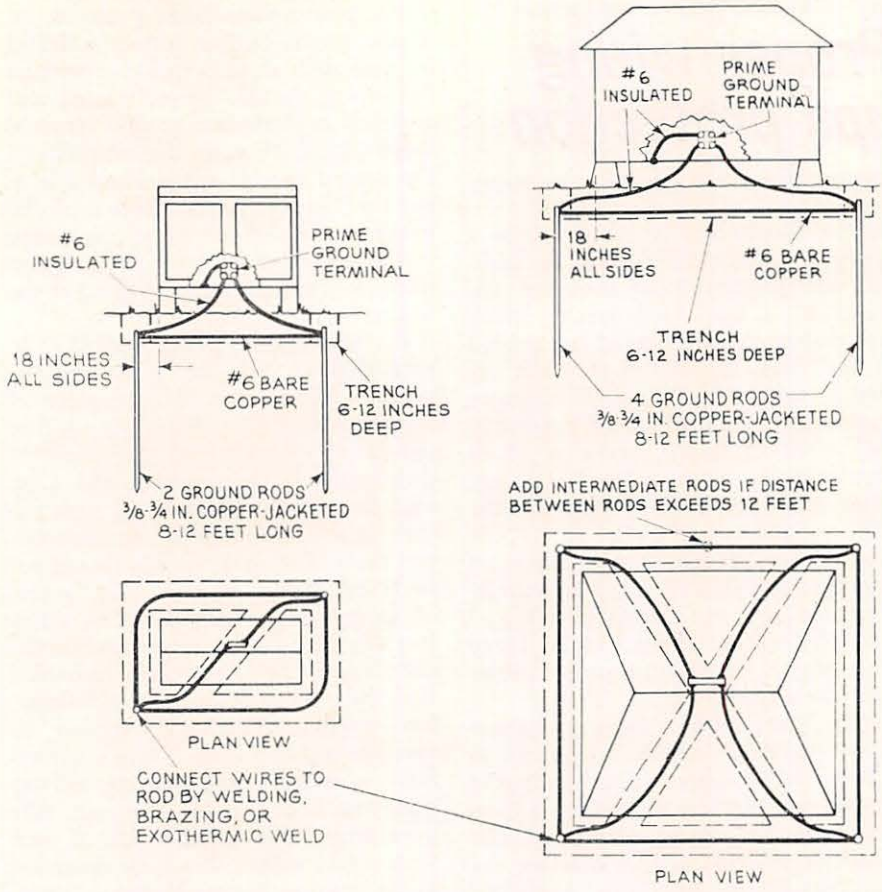
#6 INSULATED
PRIME GROUND TERMINAL
18 INCHES ALL SIDES
#6 BARE COPPER
TRENCH 6-12 INCHES DEEP
2 GROUND RODS 3/8-3/4 IN. COPPER-JACKETED 8-12 FEET LONG
#6 INSULATED
PRIME GROUND TERMINAL
18 INCHES ALL SIDES
#6 BARE COPPER
TRENCH 6-12 INCHES DEEP
4 GROUND RODS 3/8-3/4 IN. COPPER-JACKETED 8-12 FEET LONG
ADD INTERMEDIATE RODS IF DISTANCE BETWEEN RODS EXCEEDS 12 FEET
PLAN VIEW
CONNECT WIRES TO ROD BY WELDING, BRAZING, OR EXOTHERMIC WELD
PLAN VIEW

Figure 10: Suggested typical ground connection.

though, no contradiction to the principles.

The previous sections provided background material from which a set of rules can be made. The rules represent good practice in lightning protection and if adopted will provide a good degree of immunity from the hazards of lightning and transients in general. These rules are:

(1) Provide a terminal (or group of terminals of sufficient number to connect all ground wires) near floor level and near the center of the bungalow or case when possible. These terminals shall be called the prime ground terminal. Use double straps to interconnect its terminals. Connect all grounds to this point and no other. This will assure that all equipment in the bungalow maintains the same potential during discharge of a surge. All driven ground rods and any other grounds are connected to this terminal, as is a #6 wire (white insulation) leading directly to the frame of the case or bungalow (if metal) and bonded thereto. Connect shields of underground or aerial cable (if any) to the prime ground terminal.

(2) Locate arresters as near the cable entrance as is possible. (See Figure 14)

(3) Locate electronic equipment well away from the arresters.

(4) Locate and connect ground rod (s) to the prime ground terminal. A recommended arrangement for ground rods is shown in Figure 10.

(5) Locate the power entrance adjacent to the prime ground terminal so that the neutral ground connection can be made directly. Locate the AC power arrester here also.

(6) Run separate ground leads (AWG No. 6 wire) to the prime ground terminal for the track arresters and 115 volt AC power arresters (if not mounted as in 5) and for line and phone arresters if any. If there are more than ten arresters in any of these classifications, arrange them in two or more groups of up to ten arresters and run a separate #6 wire from each group to the prime ground terminal.

(7) Run incoming track leads and ground leads from arresters along the bottom or side of the case where possible and away from other wiring. Avoid sharp bends in these wires.

(8) Run twisted pair wiring well away from other wires and as directly as possible. Use #20 or #22 twisted pair for connecting electronic units to lightning arresters, filters and relays.

(9) Run 115 volt AC power leads with black and white #16 twisted pair. The white wire is the neutral, NX115 (grounded) side. The black wire is the fused, HOT or switched side. When running 115 volt AC to a piece of apparatus not grounded by being mounted on a grounded rack, or connected to ground through a separate conductor, run a third green conductor twisted into the pair to form a "triple". Connect one end to the frame of the apparatus requiring the 115 volt AC and the other end to the prime ground terminal. The use of slide straps for the neutral connection provides an easy means of disconnect for testing purposes but the ground wire should not be disconnected by the strap.

(10) Run a #10 copper wire (white insulation) from the prime ground terminal to all racks that are not grounded through mounting on a steel bungalow or case member which is grounded through the #6 wire specified in rule 1. Also connect with a #10 wire, any electronic equipment not grounded either through rack mounting or the green wire in the 115 volt AC supply cable mentioned in rule 9. Battery chargers should be so grounded. Avoid the establishment of two or more ground paths to any single piece of equipment. Any ground connection should be made mechanically secure so that it cannot become inadvertently disconnected.

(11) Connect the individual cells of a battery (when used) with short heavy straps, #6 or heavier. Avoid loops in these straps. Semi-rigid bars would be best. Locate the cells as close to each other as possible.

(12) When a battery is shared with other loads which have leads extending outside the case or bunglow, install a balanced-to-ground filter such as the GRS DC power filter (58496-41 Gr. 1) adjacent to the electronic unit and connect it with #20 or #22 twisted pair wire. Connect the power filter by a #20 or #22 twisted pair with overall PVC jacket to an equalizing arrester, installed near the battery. These connections are shown in Figure 14. Connect this battery arrester to the battery terminals with #16 twisted pair wire and a series fuse for the protection of this wire (20 amp Fusetron). If the battery potential is over 20 volts, use two such arresters in series (20 volts maximum per arrester). Install an airgap arrester from each side of the battery to ground at the point of distribution for the non-electronic load. If all incoming wires are equipped with arresters, or if the battery is not shared with other loads, these two airgap arresters may be omitted.

The background that the previous sections have provided can also be used to establish a set of rules governing tower and building wiring. Wire sizes are specified for proper handling of lightning and grounding currents and color codes are specified in conformance with industrial standards to

Proper wiring ups protection

eliminate confusion in wiring practices where possible. Conformance with this set of specifications will insure the reduction of interference to acceptable levels and reduce catastrophic failure caused by lightning and other surges to a minimum. These rules are:

(1) Provide a single heavy copper plate to serve as a prime ground terminal. It should be large enough to provide termination for all wires to be grounded.

(2) To this prime ground terminal connect the driven ground rod network, the building steelwork (if any), the neutrals of the AC power supply, the telephone ground, the frames of racks holding power equipment, the frames of all transformers, motors and generators, the ground leads from lightning arresters, and heavy ground leads from the rails of the yard and crest. In addition, bond underground water and gas pipes and any other pipes entering the building at the point of entry and connect to the prime ground terminal. These connections should be made with #6 wire as a minimum with larger conductors employed for longer runs. (#2 min. to arresters and rack grounds, and #3/0 or #4/0 for the long runs to ground the rails.) Use at least two ground leads of #1/0 or larger to connect the prime ground terminal to a peripheral array of ground rods around the building.

(3) Provide auxiliary ground terminals connected to the prime ground terminal with #1/0 wire in accordance with the interface arrangement shown in Figure 13. These terminals will serve as an extension of the prime ground terminal. No arresters should be connected to these terminals.

(4) Provide all wires entering the tower with arresters having a maximum breakdown voltage of 1200 volts or less. If economics dictates that any wires are not to be so equipped, the equipment served by these wires must be wholly separated from equipment so equipped. Conductors leading from unprotected equipment to protected equipment must be equipped with arresters. Leads to all electronic equipment should be protected by arresters. Locate all arresters as close to the cable entrance as possible, and adjacent to the prime ground terminal.

(5) When junction boxes or cases are used to house field equipment connected by cable to a tower or building, these housings should be grounded by at least two ground rods and a heavy conductor running to the tower and connected to the prime ground terminal. Any of these cases containing electronic equipment should additionally be provided with arresters and its own prime ground terminal. This terminal (connected as shown in Figures 10 and 14) should also be connected by a heavy conductor to the tower. In addition, all junction boxes mounted adjacent to a track and serving track mounted equipment should be bonded to that track, directly, if no track circuit is involved or through a heavy duty arrester if a track circuit is present; with a #6 or larger conductor which should be in close proximity to any other conductor running between the same two points.

(6) Wires leading from arresters on into the tower should be kept physically separated from the incoming leads and from the arrester ground leads. These wires should be run in separate cables and wire chases.

(7) Wires leading from equipment in one transient level to equipment in a lower transient level should be routed through an interface rack where a transient reduction device is mounted. The wires on one side of this interface device should be physically separated and run in separate cables and wire chases. The wire chase if metallic should not be electrically continuous past such an interface. Wherever possible, twisted wire should be used at interface points and each circuit should share a twisted pair with its return current from such a device.

(8) Racks holding equipment operating at the Supervisory or Computational transient level should be separated from the racks of equipment operating in the unlimited or power transient levels by as great a distance as tower or building design will permit.

(9) Run AC power wiring in twisted pairs and make the neutral connection at the point of fused distribution. Ground the neutral connection at the first distribution point from the transformer secondary. It should not be fused at any location. Keep AC power wiring physically separate from all other circuitry and run it in its own conduit or raceway where feasible. It should not be cabled with wires of other circuits. The wire insulation should be black on the fused side (or black and white tracer) and white on the neutral side (or white with black tracer). When this pair serves a piece of apparatus not otherwise grounded through its mounting, a third green wire twisted into the pair to form a triple should be attached to the frame of the apparatus on one end and to the prime ground terminal at the other.

(10 Provide AC power arresters on all AC power wires leading into or out of the tower. Similar arresters should be provided at any case or junction box where the AC power is used and gounded to the prime ground terminal there with a #6 wire. Use arresters on the neutral as well as the fused side in junction boxes or cases remote from the tower because of the surge impedance in the neutral lead, back to the point where it is metallically grounded at the tower.

(11) Run DC power circuits in twisted pairs. Run one pair from the point of distribution to each piece of apparatus requiring the power. A fuse should be provided at the point of distribution in the postitive side. Connect the negative sides of all such circuits at a buss adjacent to the distribution fuses. The negative side should not be fused. Where several similar pieces of apparatus are located within a few feet of each other, a single lead to the distribution may be used, provided that these units do not mutually interfere through impedance coupling on the shared power lead. Where consideration of safety circuits as in railway signaling line circuits does not take precedence, the negative side of each such power supply should be grounded at the negative battery terminal. Separate the distribution busses into "clean", "dirty" and "charger" portions. Separate both the plus and the minus busses. "Clean" and "dirty" refer to transients applied to these busses. The battery negative terminal will now have 4 wires. If the "dirty" buss is connected to wires extending outside of the tower, a lightning arrester of the air gap type should be located at the "dirty" buss connections (both positive and negative) and a common #6 wire run to the prime ground terminal. The wires from the battery to the separated busses should be #6 or heavier to reduce common impedance coupling between the circuits served at each buss. Battery straps in either case should be as heavy as possible with #6 being an absolute minimum. DC power wires may be run loosely with the signal wires but tight cabling and lacing should be avoided. Wire insulation color coding where possible should be red for the positive wire and brown for the negative wire.

(12) Low voltage AC lighting circuits should be treated in the same manner as power voltage AC circuits insofar as the use of twisted pair, distribution, fusing, color coding and grounding is concerned. This wiring should be kept physically separate from the AC power circuits. It should also be kept separate from any low level signal leads whether or not they are run in shielded cables.

(13) Grounds for the above power

supply circuits should be made in one place only. With the exception of the 115 volt AC power ground, these grounds should be made in such a way that they may be conveniently removed, periodically, to check that no other ground is present on the system. The use of suitable switches, contactors, slide straps or test posts is recommended. For the 115 volt power, separate slide straps or test posts should be used on the neutral of each branch circuit or group of circuits that has a separate fuse so that these circuits may be checked individually. (The main ground connection for the 115 volt AC power should never be disconnected.)

(14) High impedance low level, signal circuits should be minimized and eliminated where possible. Where not possible, these circuits should be wired with twisted pair shielded cable. Metalized Mylar shield with bare tinned #20 or #22 drain wire should be used. The companion return portion of each individual circuit should always be twisted with each signal lead and the circuit grounded and/or commoned at the signal source if possible. The shield should be grounded at the end least exposed to transients and should not extend uninterrupted past interface points. The two conductors may be identified by any suitable color code. The shield must be insulated throughout its length from contact with racks, conduits, or other shields. Circuit boards of high impedance circuits should be properly shielded or shaded.

(15) Circuit boards and wiring for interface racks should be designed to provide a means of physical separation of the wiring of the interfaced circuits. Circuit boards should be provided with grounded copper barriers between such wiring to reduce coupling. Circuit boards should be coated with a suitable insulating coating to prevent coupling by surface leakage due to dirt and moisture.

(16) If the tower is of wood, masonry or masonry and steel construction, air terminals of height adequate to protect the tower and any roof-installed equipment should be provided according to the principles outlined in the Lightning Protection Code of the National Fire Protection Association. (pamphlet 78; ASA C5.1-1968).* If of steel construction the bonding principles outlined in the code should be followed. Downleads and/or steelwork subject to lightning currents should be connected directly to the grounding network buried at the base of the building.

* *To obtain a copy of the Lightning Protection Code, send $1.25 to National Fire Protection Assn. 60 Batterymarch Street, Boston, Mass. 02110*

View from the Crossarm

Need for S&C training

That there is a tremendous need for skilled technicians to install and maintain signal and communications equipment is not in doubt. Just look around you today and notice the multitude of complex electronic equipment utilizing such advanced techniques as semi-conductors and integrated circuits. Also, to be noted is the fact that there has been a steady installation rate of communications and signal equipment over the last decade. Information supplied annually to *Railway Signaling & Communications* indicates that signal equipment has been installed at a rate of 6,000 units per year and communications equipment at a rate of approximately 20,000 units per year.

An indication of the magnitude of signal and communications equipment installed, over the last decade, may be estimated by the following: mileage of microwave systems has jumped from 4,000 to 35,000; track mileage of centralized traffic control has risen from 36,000 to 52,000; and the number of automatic classification yards placed in service, or under construction on railroads, has increased from 30 to 60. Admittedly, these are just indicators, but all three involve the installation and maintenance of electronic equipment. The complexity of this equipment may, and in some cases must meet federal regulations, that requires maintenance personnel hold second-class, radio-telephone licenses issued by the Federal Communications Commission.

It would appear obvious (however it is not obvious to the non-technical or non-engineering-trained personnel) that to keep one of these multi-million dollar automatic classification yards in 24-hour, 7-day per week, yearly operation, necessitates constant vigilance and immediate use, when emergencies arise, of skilled maintenance personnel to reduce delays and downtime to minimums.

In most cases, the railroads do have the personnel in signal and communications departments to maintain this equipment. However, as the more complex equipment is being installed and more of it is in service, there is often the need for upgrading the skill of the maintenance personnel to maintain the new equipment.

Also more training is needed for the semi-skilled maintenance personnel so that they are able to handle the complex equipment when emergencies arise.

It has been emphasized in *Railway Signaling & Communications* several times before, of the importance and need for training of maintenance personnel. A good reference to be consulted is the Oct. 1967 issue of RS&C, page 36. It was a detailed analysis of the signal training situation. Fortunately, since that time, there has been an improvement. Many more railroads are now providing training for their personnel. We expect to report on some of these training programs and the progress being made, in RS&C next year.

But there is one point that still needs to be stressed, namely, there must be an understanding and an appreciation by top management of the importance of skilled maintenance personnel. It is quite obvious to the operating officials when trains are delayed due to signal failures, but this is one of the more obvious situations. There are other conditions which cause temporary failures of equipment which normally would be eliminated or considerably reduced by an extensive preventive maintenance program. However, many roads, at the present time, are experiencing shortages of trained personnel in the signal installation and maintenance, and communications areas. Particularly with the strong demand for installation of new equipment and facilities, many preventive maintenance programs are reduced to minimums. Often maintenance today is really trouble shooting.

It is interesting to note management's understanding or attitude toward the technical departments. One signal superintendent of a rapid transit system once commented that his top management very seldom paid much attention to his department or its efforts. However, he noted, let one signal fail and hold up trains, and he received immediate management attention. He and other signal engineers, no doubt, would like to have at least some of this management enthusiasm and attention in emergencies, spread over the entire year and devoted to helping and understanding the problems and solutions thereof to technical equipment maintenance.

Included in top management's understanding is an understanding from the personnel, labor relations and training officers. Unfortunately, on some railroads the technical department head, while realizing the need for training programs, has been unable to convince top management, training and personnel officers of the needs and requirements for his men to be technically trained. Many roads that have excellent training programs for car men and locomotive mechanics, do not or apparently will not spend the money or the time or the effort to train signal or communications maintenance personnel.

In summary, provision of skilled maintenance personnel in signal and communications departments is a responsibility not only of the individual department head, but of personnel, labor relations and management officers. Only by a cooperative effort on the part of all, will signaling and communication systems be maintained properly so that they work safely and efficiently at all times.

Data Modem Characteristics

Prepared by Leo J. Ritter Staff Engineer, Communications & Signals, Penn Central. Reprinted by permission of John McNabb, Engineer, Communication & Signal Section, AAR.

Manufacturer	IBM	IBM
Model	1A Leased Line Adapter	1B Leased Line Adapter
Transmit and/or receive	Transmit & receive	Transmit & receive
Full and/or Half Duplex	Half duplex	Full or half duplex
Dial up or Private Line Application	Private line	Private line
Turn around time (HDX)	200 ±55 ms	20 ±5 ms
Automatic answer capability	No	No
Type modulation	FSK	FSK
Operating Frequencies	1,400 & 2,000 Hz	1,400 & 2,000 Hz
Clock, internal or external	***	***
Loop back testing feature	***	***
Error rate	—	—
Error detection and/or correction	No	No
EIA RS-232-B interface	No	No
Bit or character rate	0-600 bits/sec	0-600 bits/sec
Serial or parallel transmission	Serial	Serial
Impedance to line, ohms	600	600
Impedance to data equipment, ohms	600	600
Voltages to and from data equipment	***	***
Frequency stability	—	—
Level stability	—	—
Output levels to line, dbm	—8	—8
Input levels from line, dbm	—32 min.	—32 min.
Line requirements, frequency response	4A voice	4A voice
Line requirements, envelope delay	1 ms 1,000-2,400 Hz	1 ms 1,000-2,400 Hz
Line requirements, impedance	600	600
Line requirements, signal to steady noise	—	—
Line requirements, signal to impulse noise	—42 dBm	—42 dBm
Method of operation	2 wire	4 wire
Temperature and humidity limits	***	***
Power requirements	***	***
Dimensions and weight	***	***
Digital or analog	Digital	Digital

Note: *** IBM adapters useable only with certain IBM terminals and computers. The adapters are physically part of the data equipment.

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142	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**	**151**	**152**	**153**	**154**	**155**	**156**	**157**	**158**	**159**	**160**				

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Railway Cybernetics

• The following bibliography is presented to help those readers who desire to obtain information about automatic car identification.

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NEWS BRIEFS

(Continued from page 10)

Ala., 40.3 miles single track. SOU stated in its application that "this system has not been significantly altered in its operation or the devices employed since it was installed over 40 years ago. The number of trains has declined substantially . . . Of the 2,765.8 total road miles involved in this application, there is now no passenger service over 912.9 miles. Where there still is passenger service only one train operates daily in each direction, except between Spencer, N.C. and Howell, (Atlanta) Ga., where there are two trains in each direction daily. With the decrease in traffic the automatic train stop system is neither needed or warranted to protect the safety of the lives or property of the public or railroad employees, or the property of the railroad."

● TELPAK tariff to have been effective Nov. 1, has been postponed for 90 days by the Federal Communications Commission. "In view of the substantial increases the company now proposes, we feel compelled to exercise the extent of our statutory authority and suspend for three months the proposed tariff schedules for Telpak," the Commission said, according to *Telecommunications Reports*.

Regarding Telpak, the FCC said it is "cognizant of the fact that the intervenors in [the telephone rate case] have not yet had the opportunity to present their cases, which presumably would seek to establish that the original rates were compensatory and that competitive necessity requires their maintenance at the present level. The revised tariff schedules for Telpak presently before us propose substantial increases as did the presently existing tariff schedule, which became effective approximately a year ago." Consequently, the Commission said, it was suspending them for the full 90-day period.

● UNION PACIFIC has placed its complete operating information system into service. COIN continuously monitors operations over UP's 9,600-mile system through a network of 54 IBM 1050 machines located in 39 yard offices around the railroad. Information on equipment and cars, loaded or empty, is recorded on punch cards and fed into the central computer at Omaha at the time the move takes place. The computer processes the information and makes it available in memory banks accessible for inquiry. At the same time the computer transmits the information to any of the 134 locations connected to COIN which may have been designated by the location originating the information. Fifty-eight model 28 Teletype machines have been installed in 53 UP traffic offices around the country. These points can inquiry the computer concerning car moves and equipment in less than three seconds. Full information on the car and its current location can be obtained from the computer. UP has 3,194 miles of microwave systems in service and another 413 miles under construction. The microwave system extends from UP headquarters in Omaha over the entire mainline to Los Angeles, Calif. and Portland, Ore.

● WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY expects to break ground shortly for the start of $60 million of construction for subway system in Washington, D.C.

Railroad Personnel

● CHESAPEAKE & OHIO/BALTIMORE & OHIO: **William A. Jones,** signal & communications application engineer appointed leading signal application engineer at Huntington, W. Va.

● CHICAGO & NORTH WESTERN: **W. B. Ellis,** general superintendent motive power, appointed assistant vice president and director of industrial engineering.

● DENVER & RIO GRANDE WESTERN: **Robert N. Lehnertz,** communications specialist, Chicago & North Western, appointed office engineer, communications, with headquarters at Denver, Colo.

● NORFOLK & WESTERN: **J. L. Nash,** assistant to regional engineer signals and communications, at Cleveland, has retired.

● SOUTHERN PACIFIC: **Michael C. Fulks, Jr.,** appointed principal assistant signal engineer. **John A. Robinson** appointed assistant signal engineer, succeeding Mr. Fulks. **Ralph D. Sheary,** assistant signal engineer, has retired.

● SOUTHERN: **John L. Jones,** assistant vice-president in charge of computer activities at Atlanta, appointed vice-president-management information services. **Clyde W. Beasley,** signal and electrical supervisor, Alexandria, Va., appointed signal and electrical construction engineer at

(Please turn to page 34)

Data Modem Characteristics

Prepared by Leo J. Ritter Staff Engineer, Communications & Signals, Penn Central. Reprinted by permission of John McNabb, Engineer, Communication & Signal Section, AAR.

Manufacturer	IBM	IBM
Model	1A Shared Line Adapter	1B Shared Line Adapter
Transmit and/or receive	Transmit & receive	Transmit & receive
Full and/or Half Duplex	Half duplex	Full or half duplex
Dial up or Private Line Application	Private line	Private line
Turn around time (HDX)	200 ±55 ms	20 ±5 ms
Automatic answer capability	No	No
Type modulation	FSK	FSK
Operating Frequencies	820 & 990; 1,640 & 1,810; 1,230 & 1,400 or 2,050 & 2,200 Hz	820 & 990; 1,640 & 1,810; 1,230 & 1,400 or 2,050 & 2,200 Hz
Clock, internal or external	***	***
Loop back testing feature	***	***
Error rate	—	—
Error detection and/or correction	No	No
EIA RS 232-B interface	No	No
Bit or character rate	0-134.5 bits/sec	0-134.5 bits/sec
Serial or parallel transmission	Serial	Serial
Impedance to line, ohms	600	600
Impedance to data equipment, ohms	600	600
Voltages to and from data equipment	***	***
Frequency stability	—	—
Level stability	—	—
Output levels to line, dbm	−14	−14
Input levels from line, dbm	−38 min.	−38 min.
Line requirements, frequency response	4A voice	4A voice
Line requirements, envelope delay	1 ms 1,000-2,400 Hz	1 ms 1,000-2,400 Hz
Line requirements, impedance	600	600
Line requirements, signal to steady noise	—	—
Line requirements, signal to impulse noise	−42 dBm	−42 dBm
Method of operation	2 wire	4 wire
Temperature and humidity limits	***	***
Power requirements	***	***
Dimensions and weight	***	***
Digital or analog	Digital	Digital

Note: *** IBM adapters useable only with certain IBM terminals and computers. The adapters are physically part of the data equipment.

NEWS BRIEFS

(Continued from page 32)

Atlanta. **James T. Stucker,** assistant signal and electrical supervisor, Hattiesburg, Miss., appointed signal and electrical supervisor, Alexandria, Va. **Robert T. Mitchell,** signal and electrical draftsman, Atlanta, appointed assistant signal and electrical supervisor, Hattiesburg, Miss. **John W. Smith,** management trainee, Atlanta, appointed signal and electrical construction supervisor, Knoxville, Tenn.

Supply Trade News

● ABEX CORP: **Ross H. Chambers** appointed sales representative, St. Louis sales office, at 411 N. 7th St.

● BRAND-REX DIV., American Enka Corp.: **John P. O'Connor,** formerly vice president of marketing services of Harvey Hubbell, Inc., has been appointed director of sales and marketing.

● CUSHMAN ELECTRONICS INC.: **Hal Farnsworth,** formerly eastern regional sales manager Sierra Electronic Division of Philco-Ford, has been appointed director of telecommunications sales.

● ERICO PRODUCTS INC.: **John H. Sawyer,** retired regional engineer communications and signals, Penn Central, appointed consultant, electronics division.

John H. Sawyer
Erico Products

Edward A. Holland
Exide—ESB Inc.

Thomas E. Peacock
Exide—ESB Inc.

Charles L. Eaton
General Electric

● ESB INC., Exide Power Systems Div.: **Thomas E. Peacock,** formerly manager of Central-South sales region, appointed director of marketing services and **Edward A. Holland,** former manager of Northeast sales region, appointed general sales manager.

● GENERAL ELECTRIC CO.: **Charles L. Eaton,** manager of Telecommunication and Information Processing Operations in Schenectady, appointed general manager Telecommunications Products Department, Lynchburg, Va.

● GENERAL RAILWAY SIGNAL CO.: **Dr. R. Gordon Cook,** former assistant professor of mechanical engineering, Massachusetts Institute of Technology, has been named market planner.

● GRAYBAR ELECTRIC CO.: **J. F. Pearce** appointed manager at Lakeland Fla. **A. T. Reciniello** appointed manager at St. Petersburg, Fla. **R. T. Sanderson** appointed manager at Raleigh, N.C. **W. N. Chalfant** appointed manager at Wilmington, Del. **R. W. Sylvester** appointed manager at Tallahassee, Fla. **W. B. Whaley,** executive vice president and treasurer, elected president succeeding **John Reine** who has retired.

● KOPP GLASS INC.: **Bruce McNally** appointed assistant sales manager.

● LENKURT ELECTRIC CO. INC., will construct a new manufacturing plant in Albuquerque, N.M. The new 200,000 sq ft facility will be used to produce carrier and multiplex equipment. Manufacturing operations are expected to begin during the summer of 1971.

● MID-CONTROL CO.: **Donald W. Ryder** appointed sales engineer. He was

Hand-thrown or remote-controlled

Hayes ALL-STEEL DERAILS

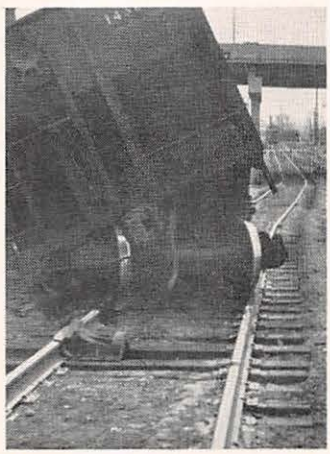
physically protect the main line

Derails or signals? Each has its place: signals are obeyed by men; Hayes Derails are obeyed by equipment.

When signals are not involved, the Hayes Derail alone is competent to keep the main track clear.

In modern signal systems, the Hayes Sliding Derail with DeLectric® Operator under remote control provides complete protection.

The "calculated risk" of omitting derails may be costly. Hayes Derail protection is inexpensive.



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RICHMOND, INDIANA 47374

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You can get one—quick. Just dial (609) 963-8000. At extension PH-311, you'll get all the facts about RCA service: contractual, per call, or emergency. Coast-to-coast service is offered by RCA for the account of the manufacturer and large user. Check on it. Phone today, or if you prefer, write RCA Service Company, A Division of RCA, Bldg. CHIC-225, Camden, N. J. 08101.

RCA

Circle 13 on reader service card

Harold E. Woodhouse
Simmons-Boardman

Donald W. Wessels
Sylvania Electric

formerly with Okonite Co. and Shell Oil Co.

● OKONITE CO.: **Fredrick A. Davies** appointed manager of Salt Lake City district. **James G. Protzer** appointed sales representative Chicago district.

Douglass S. List, vice president—marketing, Wire and Cable Division, announced a restructuring of the marketing department to improve service to customers. Reporting to List will be **Julian R. Hoss,** vice president—general sales manager; **Harry A. Penhale,** manager—customer quotations; **Jack G. Wicks,** vice president—director of marketing; **Donald C. Huber,** manager—advertising and public relations; and **Edward Danielson, Jr.,** vice president—communications and instrumentation products. Communications and instrumentation products include Ken-Tel telecommunications cable, Okoflex instrument tubing, and Jefferson Wire & Cable Corp. product lines.

● RADIO CORP. OF AMERICA: **Barton Kreuzer** elected executive vice president who will be responsible for the commercial electronic systems. He was formerly division vice president and general manager.

● RAILROAD ACCESSORIES: CORP.: **Elford L. Wall,** formerly in the signal department of Western Pacific, has joined the firm as its sales and service representative with headquarters at Pleasanton, Calif. Long Supply Co., 1720 Algonquin Road, Mt. Prospect, Ill. 60056, has been appointed distributor, sales and service representative in the midwest region of the U.S. Principal managers are **J. R. Long** and **H. W. Watkins.**

● SIMMONS-BOARDMAN PUB. CORP.: **Harold E. Woodhouse,** former manager railroad training systems, Link division, The Singer Company, appointed manager, locomotive and train simulator division, Railway Educational Bureau. S-B has decided to actively pursue the idea of acquiring a locomotive and train simulator, as part of its REB operation. Mr. Woodhouse was formerly signal engineer, New York, Susquehanna & Western, assistant regional sales manager for Thomas A. Edison Industries, and general sales manager for Western Railroad Supply Co., just before joining Link.

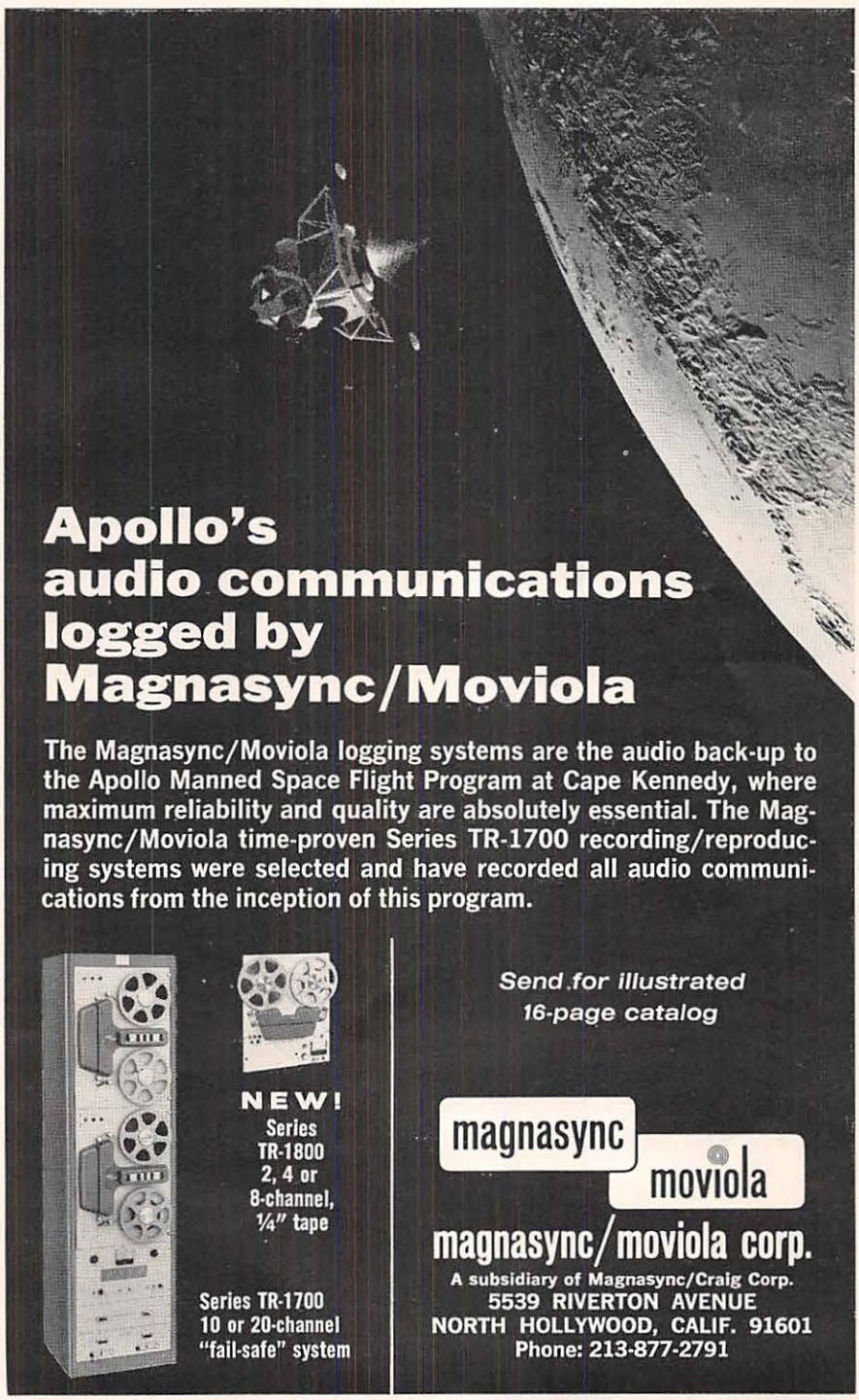
● SYLVANIA ELECTRIC PRODUCTS INC.: **Donald W. Wessels,** western regional manager Chicago, named manager railroad sales for the commercial electronics division and will be responsible for sale of KarTrak ACI systems. **Robert L. Smith,** marketing manager, appointed manager-systems applications. Mr. Smith is responsible for development of new ACI systems which can be used, not only by railroads, but in the transit and trucking industries.

● TELECOMMUNICATIONS INDUSTRIES INC.: **George O. Bilodeau,** manager of sales administration for ITT Telecommunications, elected vice president-marketing.

● WESTINGHOUSE AIR BRAKE CO., Signal & Communications Div.: **W. T. Goff** appointed sales engineer at the western regional office in Chicago. **G. W. Gubanich,** formerly sales engineer at Philadelphia, appointed senior marketing engineer-rapid transit sales with headquarters at Pittsburgh.

W. T. Goff
S&C Div. Wabco

G. W. Gubanich
S&C Div. Wabco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logged by
Magnasync/Moviola
The Magnasync/Moviola logging systems are the audio back-up to the Apollo Manned Space Flight Program at Cape Kennedy, where maximum reliability and quality are absolutely essential. The Magnasync/Moviola time-proven Series TR-1700 recording/reproducing systems were selected and have recorded all audio communications from the inception of this program.
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Now is the time to sell your obsolete line wire!

When plans call for going underground, a big part of the problem is up in the air. Diversified Dismantling Corporation, with its miles of experience in removing and salvaging communication wire and poles over every type of terrain and through congested neighborhoods, can take care of the problem for you and increase your salvage revenue.

Write, wire or call collect:

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Subsidiary of Diversified Metals Corporation
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new look in january 1970

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RAILWAY SYSTEM CONTROLS

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Automatic block system
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Electronic track circuits
Level crossing equipment
Automation in marshalling yards
Retarders
Mechanical
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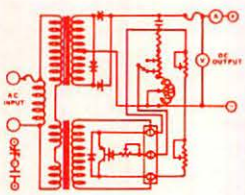
and electronic operation of
all safety and
signalling equipment.

publiscope

Circle 16 on reader service card

LaMarche makes all these types of power equipment

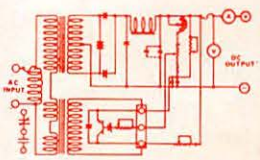
FLOAT CHARGERS



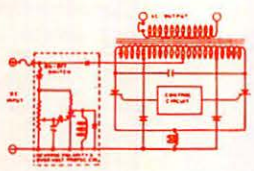
The LaMarche chargers are utility grade equipment designed to carry continuous loads up to maximum rated capacity. Designed and built to the most exacting specifications. Optional accessories allow for easy adaptation to all system requirements.

DC POWER SUPPLIES

Four power supply models are offered with DC output ranges from 3 amperes to 400 amperes, 12 volts through 260 volts DC. Various levels of filtering, regulation and output adjustment are offered. Available for any AC input voltage.



INVERTERS

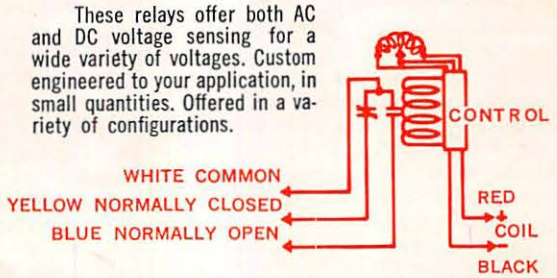


DC to AC inverters are designed to provide continuous AC power. Transistorized circuit, square wave or sine wave output. For 12, 24, or 32 VDC input. 400, 800, and 1200 volt ampere output at 120 volts AC.

SCR circuit, square wave or sine wave output. For 24, 48, 120 volt DC input. 400 VA to 5K at 120 or 240 volts AC output.

VOLTAGE SENSING RELAYS

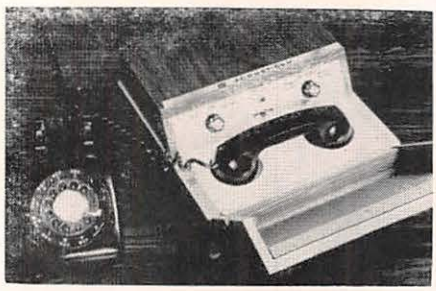
These relays offer both AC and DC voltage sensing for a wide variety of voltages. Custom engineered to your application, in small quantities. Offered in a variety of configurations.



LaMARCHE
Manufacturing Company
106 Bradrock Dr., Des Plaines, Ill. 60018

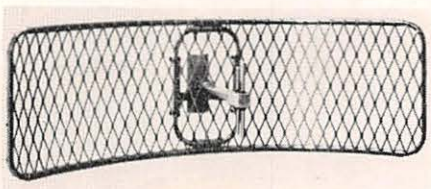
Circle 17 on reader service card

Product News



Data Terminals

Acousticom conversational data terminals are available with either integral or separate acoustic couplers. Series 233 terminals feature integral couplers; full size, reliable Teletype 33's; and paper tape punch/reader, if desired. Terminals (all Teletype 33's) with separate couplers include: Acousticom 260 Terminal with model 260 acoustic originate coupler for remote access to a computer center; Acousticom 262 terminal with model 262 dual-input originate coupler for remote computer access plus dual inputs for alternate use of teletypewriter and EIA device . . . in off-line operation, the 262 permits card to punched tape conversation; and the Acousticom 300 terminal with model 300 originate/computerside coupler for use in computer center for coupling phone to buffer or CPU. Or the 300 terminal can be used remotely for transmission to another acoustic coupler and/or computer. *Oneida Electronics Inc., Circle 101 on Reader Service Card.*



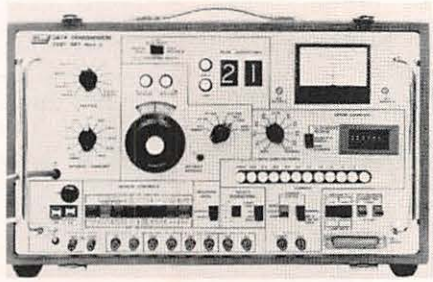
Antenna

The DB-496, 940-960 MHz point to point communications antenna features a sealed double dipole feed as a primary directional radiator illuminating an expanded aluminum cylindrical parabolic reflector. Featuring light weight (7.5 lb including clamps) and extremely low windload, this ruggedized antenna meets all pertinent FCC rules and regulations for this frequency band. Gain is 13.5 dBi. *Decibel Products Inc., Circle 102 on Reader Service Card.*

Multiplex

A new low density version of the MC 300 series SSBSC multiplex is fully transistorized. The equipment accommodates up to 72 channels and has a 100% data loading capability at —5 dBmO/channel. Integrated circuitry in all carrier generation provides greater reliability. The equipment also has an improved four wire terminating set for better frequency response, return loss characteristics, trans-hybrid characteristic and longitudinal balance.

A unique VF limiter is provided in every channel as standard equipment to prevent distortion and improve quality. The equipment is also fully synchronized as a standard feature, eliminating error at any station or throughout the system. Since the high density multiplex and the low density configurations use the same channel modems, only one type of equipment is needed for all stations on a system, eliminating the need for field modification for future expansion. The equipment operates off of a 24-volt station battery which requires no external regulators. Both 48 volt DC or 120 volt AC operation are available optionally. *Motorola Communications & Electronics, Inc. Circle 103 on Reader Service Card.*



Data Test Set

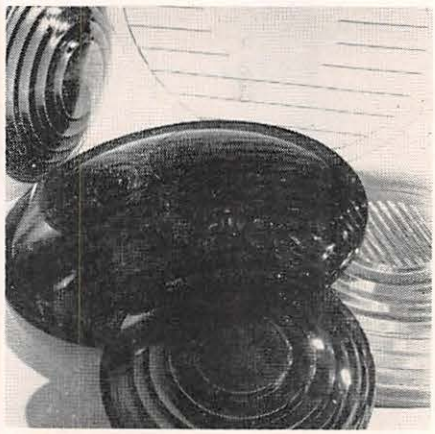
Trend model 1-3 generates and receives asynchronous or synchronous digital data at rates from 24 to 9600 bits/sec, controlled either by built-in or external clock. Various 1 and 0 patterns are supplied, including a 511-bit pseudo-random pattern.

The receiver and measuring circuits provide three readings: peak telegraph distortion, bias distortion and error count. Telegraph distortion is shown as a percentage on a two digit decimal display, which can be controlled to reset automatically every two seconds, or to give a continuous display of the maximum degree of distortion detected. The set will synchronize on purely random patterns. Bias distortion is shown on a direct-reading meter scaled from 100% binary 1 bias through 0 to 100% binary 0 bias. Error count is by a binary-coded lamp display for counting errors up to 2047, and by a six-figure resettable electromagnetic counter which performs three functions: counting the number of pseudo-random blocks that contain one or more errors; counting the total number of blocks received; or extending the total error count to a maximum of 2047 x 10^6.

While an error is normally defined as a signal element that is distorted by 50% or more, a control is provided on the receiver to vary the error-threshold level from 50% down to 0% in 5% steps. The modem interface connector is standard 25 pin EIA, RS-232B. Simple push-button controls at the receiver are illuminated to indicate sync and phase locking. Modem control buttons command and display status of modem functions. *Transmission Measurements Inc., Circle 104 on Reader Service Card.*

Insulation Tester

The new insulation testing instrument, model E-1712, is self-powered. It may be used in a wide range of field and bench service operations. It weighs less than 6 lb. A built-in voltage generator, with a constant voltage device, provides 2,500 volts and will measure extremely small insulation leakages with sensitivity to 10,000 megohms. Any leakage is displayed on an accurately calibrated meter. The unit does not require external power or batteries. Although a precision instrument, it is highly resistant to shock, vibration, and external magnetic fields. The E-1712 utilizes light alloy castings with special seals against dust, oil, and moisture and complies with stringent industrial construction standards. Other models in the E-17 series are available in ranges down to 100 volts. *Japanese Products Corp. Circle 105 on Reader Service Card.*



Plastic Lenses

Signal lenses subject to damaging effects of weather and impact shock as well as heat resistance where the signal light burns constantly are available in Tenite butyrate. Also lenses of molded butyrate have been used for switch lighting and crossing flashers. *Eastman Kodak Co. Circle 106 on Reader Service Card.*

UCAR "6-PACK"

new source of multi-purpose power!

Union Carbide's "Ucar" "Air Cell" primary batteries are a new concept in premium performance from a proven power source.

The air-depolarized Ucar battery stands unchallenged —with no comparable units commercially available today!

Utilizing the dependable carbon-zinc-caustic system, the Ucar "6-Pack" has been engineered to set completely new standards of operating flexibility, reliability and power capacity.

Any of the six different batteries is available *individually*—to provide power capabilities to meet the expanding variety of applications in signaling, communications, transportation and maritime lighting. Bonnets are color-coded blue for parallel connections—red for series connections. Here are the ratings for the batteries in the Ucar "6-Pack":

TYPE	CIRCUIT	VOLTAGE	AMPERE-HOUR
2P30	Parallel	1.25	3000
2P20	Parallel	1.25	2000
3P30	Parallel	1.25	3000
2S15	Series	2.50	1500
2S10	Series	2.50	1000
3S10	Series	3.75	1000

One big reason for more power in the same size case is micro-milled lime—Union Carbide's unique battery ingredient. Up to 65 per cent greater power density than any available unit has been made possible by its use.

Ucar "6-Pack" batteries are shipped two ways: preactivated and ready to go—or accompanied by bottled liquid electrolyte for later activation.

Check the Ucar "6-Pack". Full information on this new source of packaged, instantaneous multi-purpose power is available in special Catalog Sections. For copies, write: Union Carbide Corporation, Carbon Products Division, 270 Park Avenue, New York 10017. Export: International Department, New York. In Canada: Union Carbide Canada Limited, Toronto.

THE DISCOVERY COMPANY

UNION CARBIDE

CARBON PRODUCTS DIVISION

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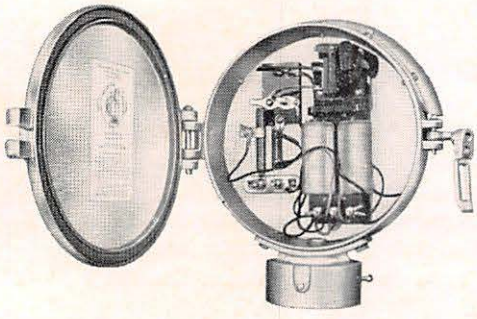
WESTERN

ALUMINUM HIGHWAY CROSSING BELLS

with BELL STEEL GONGS TYPES 222 AND 1275

WEIGH 40% LESS THAN CAST-IRON BELLS

These new Western Aluminum Highway Crossing Bells, Types 222 and 1275, are lighter in weight and as reliable as ever. Specifically: the Type 222 Aluminum Bell weighs only 29 lbs., as against 48 lbs. for that of cast iron, and the Type 1275 in Aluminum weighs only 20 lbs. against 32 lbs. for the cast iron. Aluminum parts include: housing, cover, rainshield, and mounting socket. These changes make quite a difference in weight. But there's no difference in quality and tone: for they have the same dependable mechanism as before; as always, parts are fitted snugly to assure bug-, dust- and weather-proofing, and *the gong is bell steel.*



TYPE 222: Twelve-inch bell steel gong; 200 strokes per minute; 6 to 600 volts D.C., as specified.

TYPE 1275 (not shown): Same as Type 222, except with eight-inch bell steel gong (softer tone); 225 strokes per minute; 6 to 16 volts D.C.

Making greater use of aluminum throughout, these Bells are complementary for use on Western's Aluminum Highway Crossing Signal, TYPE A-479-A, with Flashing Light, TYPE 970-201, on the Aluminum Cantilever Assembly, TYPE A-740, also on Model 10 Gates.

Over 100,000 Western Bells in use.

For additional information on bells and bell mechanisms, see your W-C Catalog, Section 5, or write to us:

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Canada: Woodings Canada, Ltd., 5 Place Ville Marie, Montreal 2, Que.

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